

CONTRACT DOCUMENTS

CONTRACT NO. 0085D027

OCEAN PINES BIOSOLIDS DEWATERING PROJECT
FOR THE
WORCESTER COUNTY DEPARTMENT OF PUBLIC WORKS
WORCESTER COUNTY, MARYLAND

Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of **Maryland**, License No. 31100, Expiration Date: **January 21, 2027**.

Prepared by:

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July, 2026

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**Worcester County Administration
1 West Market Street, Room 1103
Snow Hill, Maryland 21863**



INVITATION FOR BID

PROJECT: Ocean Pines Biosolids Dewatering Project

DEPARTMENT: Public Works

VENDOR:

NAME: _____

ADDRESS: _____

BID OPENING:

DATE: August 17, 2026

TIME: 3:30 p.m.

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SECTION I: INTRODUCTION

A. PURPOSE

1. The purpose of this Invitation for Bid Document is for Worcester County (“County”) to contract for the construction of the Ocean Pines Biosolids Dewatering Project in conformity with the requirements contained herein (“Bid Document(s”).
2. The County specification requirements are in addition to the EJCDC Contract Documents. The information was coordinated between the County and EJCDC Documents, but where discrepancies are found, the EJCDC Contract Documents shall govern. Where County requirements are in excess of EJCDC requirements, the County requirements must be met in addition to the EJCDC requirements.

B. CLARIFICATION OF TERMS

1. Firms or individuals that submit a bid for award of a contract (“Contract”) are referred to as vendors (“Vendors”) in this document. The Vendor that is awarded the Contract is herein referred to as the (“Successful Vendor”). Reference to ‘Vendor’ shall equate to ‘Bidder’ as stated within the EJCDC standard specification sections.

C. QUESTIONS AND INQUIRES

1. Questions must be addressed in writing to the Worcester County Procurement Officer at nrice@co.worcester.md.us.
2. The last date to submit questions for clarification will be **noon on August 19, 2026**.

3. Addenda are posted on the County website at <https://www.co.worcester.md.us/> under County Info: Bid Board: at <https://www.co.worcester.md.us/commissioners/bids> at least five calendar days before bid opening.
4. It is the Vendors responsibility to make sure all addenda are acknowledged in their bid. Failure to do so could result in the bid being disqualified.

D. FILLING OUT BID DOCUMENTS

1. Only forms supplied by the County and EJCDC Forms prepared by Davis, Bowen & Friedel Inc. included here within shall be used.
2. One unbound original and two bound copies of the bid form and any required attachments must be submitted in the solicitation and can be submitted in the same envelope unless otherwise instructed.
3. Bid Documents should be complied as follows: (1) Cover letter, (2) Form of Bid, (3) References, (4) Exceptions Document and Signed addenda, if necessary (5) Individual Principal Document, (6) Vendor's Affidavit of Qualification to Bid, (7) Non-Collusive Affidavit, and (8) Per EJCDC Bid Form C-410.
4. Where so indicated by the make-up of the Bid Documents, sums will be expressed in both words and figures, and in the case of a discrepancy between the two, the amount written in words will govern. In the event there is a discrepancy between the unit price and the extended totals, the unit prices will govern.
5. Any interlineation, alteration, or erasure will be initialed by the signer of the Bid Documents.
6. Each copy of the Bid Documents will be signed by the person(s) legally authorized to bind the Vendor to a contract, using the legal name of the signer.
7. Vendor will supply all information and submittals required by the Bid Documents to constitute a proper and responsible completed Bid Document package.
8. Any ambiguity in the Bid Documents as a result of omission, error, lack of clarity or non-compliance by the Vendor with specifications, instructions, and/or all conditions of bidding will be construed in the light most favorable to the County.

E. SUBMISSION OF BID DOCUMENTS

1. All copies of the Bid Documents and any other documents required to be submitted with the Bid Documents will be enclosed in a sealed envelope. The envelope will be addressed to the Worcester County Commissioners and will be identified with the project name: **OCEAN PINES BIOSOLIDS DEWATERING PROJECT** and the Vendor's name and address. If the Bid Documents are sent by mail, the sealed envelope will be enclosed in a separate mailing envelope with the notation "SEALED BID DOCUMENTS ENCLOSED" on the face thereof.
2. Bids must be mailed or hand carried to the **Worcester County Administration Office, 1 West Market Street, Room 1103, Snow Hill, MD 21863**, in order to be received **prior** to the announced bid deadline. *Bids received after said time or delivered to the wrong location will be returned to the Vendor unopened.*
3. **Bids are due and will be opened at the time listed on the front of this Bid Document.**
4. If you are delivering a bid in person please keep in mind to allow time to get through security and into the Administration Office. It is fully the responsibility of the Vendor to ensure that the bid is received on time.
5. The County will not speculate as to reasonableness of the postmark, nor comment on the apparent failure of a public carrier to have made prompt delivery of the bid.

6. Vendors, or their authorized agents, are expected to fully inform themselves as to the conditions, requirements, and specifications before submitting Bid Documents; failure to do so will be at the Vendor's own risk.
7. A fully executed Affidavit of Qualification to Bid will be attached to each Bid Document.
8. Minority vendors are encouraged to participate.
9. All Vendor submitted Bid Documents will be valid for a minimum of sixty days from the date of Bid Document opening.
10. Electronically mailed bids are **not** considered sealed bids and will **not** be accepted.

F. OPENING OF BIDS

1. Bid Documents received on time will be opened publicly and Vendor's names and total costs will be read aloud for the record.

G. ACCEPTANCE OR REJECTION OF BIDS

1. Unless otherwise specified, the Contract will be awarded to the most responsible and responsive Vendor complying with the provisions of the Bid Documents, provided the bid does not exceed the funds available, and it is in the best interest of the County to accept it. The County reserves the right to reject the Bid Documents of any Vendor who has previously failed to perform properly in any way or complete on time contracts of a similar nature; or a Bid Document from a Vendor who, investigation shows, is not in a position to perform the Contract; or Bid Documents from any person, firm, or corporation which is in arrears or in default to the County for any debt or contract.
2. Completed Bid Documents from Vendors debarred from doing business with the State of Maryland or the Federal Government will not be accepted.
3. In determining a Vendor's responsibility, the County may consider the following qualifications, in addition to price:
 - a. Ability, capacity, and skill to provide the commodities or services required within the specified time, including future maintenance and service, and including current financial statement or other evidence of pecuniary resources and necessary facilities.
 - b. Character, integrity, reputation, experience and efficiency.
 - c. Quality of past performance on previous or existing contracts, including a list of current and past contracts and other evidence of performance ability.
 - d. Previous and existing compliance with laws and ordinances relating to contracts with the County and to the Vendor's employment practices.
 - e. Evidence of adequate insurance to comply with Contract terms and conditions.
 - f. Statement of current work load and capacity to perform/provide the Goods and/or Services.
 - g. Explanation of methods to be used in fulfilling the Contract.
 - h. The Vendor, if requested, will be prepared to supply evidence of its qualifications, listed above, and its capacity to provide/perform the Goods and/or Services; such evidence to be supplied within a specified time and to the satisfaction of the County.
4. In determining a Vendor's responsiveness, the County will consider whether the Bid Document conforms in all material respects to the Bid Documents. The County reserves the right to waive any irregularities that may be in its best interest to do so.
5. The County will have the right to reject any and all Bid Documents, where applicable to accept in whole or in part, to add or delete quantities, to waive any informalities or irregularities in the Bid

Document received, to reject a Bid Document not accompanied by required Bid security or other data required by the Bid Documents, and to accept or reject any Bid Document which deviates from specifications when in the best interest of the County. Irrespective of any of the foregoing, the County will have the right to award the Contract in its own best interests.

H. DESCRIPTIVE LITERATURE

1. The proposed descriptive literature fully describing the product bid is what is intended to be included as the price. Failure to do so may be cause for rejection of the bid.
2. Any items, systems or devices supplied in this bid that are proprietary in nature relative to maintenance, repair, servicing or updating must be disclosed on the bid form.

I. NOTICE TO VENDORS

1. Before a Vendor submits the Bid Documents it will need to become fully informed as to the extent and character of the Goods and/or Services required and are expected to completely familiarize themselves with the requirements of this Bid Document's specifications. Failure to do so will not relieve the Vendor of the responsibility to fully perform in accordance therewith. No consideration will be granted for any alleged misunderstanding of the material to be furnished or the Services to be performed, it being understood that the submission of a Bid Document is an agreement with all of the items and conditions referred to herein.

J. GENERAL REQUIREMENTS

1. The successful vendor must be licensed to perform work in the state of Maryland.

K. PAYMENT

1. The county will make payment(s) to the Successful Vendor within thirty (30) calendar days from the receipt of a proper invoice for approved and accepted work performed.

L. QUESTIONS

1. The last day for questions is listed under Section I, Subsection C.2.

M. AWARD

1. The county intends to award to the lowest responsive and responsible vendor meeting the specifications.

END OF SECTION

SECTION II: GENERAL INFORMATION

A. ECONOMY OF BID

1. Bid Documents will be prepared simply and economically, providing straightforward and concise description of the Vendor's capabilities to satisfy the requirements of the Bid Documents. Emphasis should be on completeness and clarity of content. Elaborate brochures and other representations beyond that sufficient to present a complete and effective Bid Document are neither required nor desired.

B. PUBLIC INFORMATION ACT (PIA)

1. Worcester County is subject to the Maryland Public Information Act and may be required to release bid submissions in accordance with the Act.
2. Any materials the Vendor deems to be proprietary or copyrighted must be marked as such; however, the material may still be subject to analysis under the Maryland Public Information Act.
 - a. The Vendor may invoke proprietary information or trade secret protection for submission of any data/material by (1) identifying the data/material in a written description, (2) clearly marking the data/material as proprietary, and (3) providing a written statement detailing the reasons why protection is necessary. The County reserves the right to ask for additional clarification prior to establishing protection.

C. CONTRACT AWARD

1. A written award by the County to the Successful Vendor in the form of a Purchase Order or other contract document will result in a binding Contract without further action by either party. If the Successful Vendor fails or refuses to sign and deliver the Contract and the required insurance documentation, the County will have the right to award to the next responsible and responsive Vendor. Contract will be executed by the Successful Vendor within fifteen calendar days of receipt of the Contract.
2. Bid Documents and Contracts issued by the County will bind the Vendor to applicable conditions and requirements herein set forth, unless otherwise specified in the Bid Documents, and are subject to all federal, state, and municipal laws, rules, regulations, and limitations.
3. County personal property taxes ("Taxes") must be on a current basis; if any such Taxes are delinquent, they must be paid before award of Contract. Failure to pay will result in the award of Contract to another Vendor.
4. The County reserves the right to engage in individual discussions and interviews with those Vendors deemed fully qualified, responsible, suitable and professionally competent to provide the required Goods and/or Services should the project size warrant it. Vendors will be encouraged to elaborate on their qualifications, performance data, and staff expertise.

D. AUDIT

1. The Successful Vendor agrees to retain all books, records, and other documents relative to the awarded Contract for five years after final payment, or until audited. The County, its authorized agents, and/or State auditors will have full access to and the right to examine any of said materials during said period.

E. NONPERFORMANCE

1. The County reserves the right to inspect all operations and to withhold payment for any goods not performed or not performed in accordance with the specifications in this Bid Document. Errors, omissions or mistakes in performance will be corrected at no cost to the County. Failure to do so

will be cause for withholding of payment for that Goods and/or Services. In addition, if deficiencies are not corrected in a timely manner, the County may characterize the Successful Vendor as uncooperative, which may jeopardize future project order solicitations.

F. MODIFICATION OR WITHDRAWAL OF BID

1. A Bid Document may not be modified, withdrawn, or cancelled by the Vendor during the stipulated time period following the time and date designated for the receipt of Bid Documents, and each Vendor so agrees in submitting Bid Documents.

G. DEFAULT

1. The Contract may be cancelled or annulled by the County in whole or in part by written notice of default to the Successful Vendor upon non-performance, violation of Contract terms, delivery failure, bankruptcy or insolvency, any violation of state or local laws, or the making of an assignment for the benefit of creditors. An award may then be made to the next most highly rated Vendor, or when time is of the essence, similar commodities and/or service may be purchased on the open market. In either event, the defaulting Vendor (or his surety) will be liable to the County for cost to the County in excess of the defaulted Contract price.
2. If a representative or warranty of either Party to the Contract is false or misleading in any material respect, or if either Party breaches a material provision of the Contract ("Cause"), the non-breaching Party will give the other Party written notice of such cause. If such Cause is not remedied within fifteen calendar days ("Cure Period") after receipt of such notice, (unless, with respect to those Causes which cannot be reasonably corrected or remedied within the Cure Period, the breaching Party will have commenced to correct or remedy the same within such Cure Period and thereafter will proceed with all due diligence to correct or remedy the same), the Party giving notice will have the right to terminate this Contract upon the expiration of the Cure Period.

H. COLLUSION/FINANCIAL BENEFIT

1. The Vendor certifies that his/her Bid is made without any previous understanding, agreement, or connection with any person, firm, or corporation making a Bid Document for the same project; without prior knowledge of competitive prices; and is in all respects fair, without outside control, collusion, fraud, or otherwise illegal action.
2. Upon signing the Bid Document, Vendor certifies that no member of the governing body of the County, or members of his/her immediate family, including spouse, parents or children, or any other officer or employee of the County, or any member or employee of a Commission, Board, or Corporation controlled or appointed by the County Commissioners has received or has been promised, directly or indirectly, any financial benefit, related to this Bid Document and subsequent Contract.

I. TAX EXEMPTION

1. Tax exemptions shall be as detailed within the EJCDC documents.

J. CONTRACT CHANGES

1. No claims may be made by anyone that the scope of the project or that the Vendor's Goods and/or Services have been changed (requiring changes to the amount of compensation to the Vendor or other adjustments to the Contract) unless such changes or adjustments have been made by an approved written amendment (Change Order) to the Contract signed by the Chief Administrative Officer (and the County Commissioners, if required), prior to additional Goods and/or Services being initiated. Extra Goods and/or Services performed without prior, approved,

written authority will be considered as unauthorized and at the expense of the Vendor. Payment will not be made by the County.

2. No oral conversations, agreements, discussions, or suggestions, which involve changes to the scope of the Contract, made by anyone including any County employee, will be honored or valid. No written agreements or changes to the scope of the Contract made by anyone other than the Procurement Officer (with the Chief Administrative Officer and/or County Commissioners approval, if required) will be honored or valid.

K. ADDENDUM

1. No oral statements of any person will modify or otherwise affect or interpret the meaning of the Contract specifications, or the terms, conditions, or other portions of the Contract. All modifications and every request for any interpretation must be addressed to Worcester County's Procurement Officer and to be given consideration, must be received no later than the last day for questions listed in Section I, Subsection C.2.
2. Any and all interpretations, corrections, revisions, and amendments will be issued by the Procurement Officer to all holders of Bid Documents in the form of written addenda. Vendors are cautioned that any oral statements made by any County employee that materially change any portion of the Bid Documents cannot be relied upon unless subsequently ratified by a formal written amendment to the Bid Document.
3. All addenda will be issued so as to be received at least five days prior to the time set for receipt of Bid Documents, and will become part of the Contract and will be acknowledged in the Bid Document form. Failure of any Vendor to receive any such addenda will not relieve said Vendor from any obligation under the Bid Document as submitted.
4. Vendors are cautioned to refrain from including in their Bid Document any substitutions which are not confirmed by written addenda. To find out whether the County intends to issue an amendment reflecting an oral statement made by any employee, contact Worcester County's Procurement Officer during normal business hours.
5. The Worcester County Procurement Officer reserves the right to postpone the Bid Document opening for any major changes occurring in the five-day interim which would otherwise necessitate an Addendum.

L. EXCEPTIONS/ SUBSTITUTIONS

1. Any exceptions or substitutions to the specifications requested should be marked on the bid form and listed on a separate sheet of paper attached to the bid.
2. An exception to the specifications may disqualify the bid. The County will determine if the exception is an essential deviation or a minor item.
3. In the case of a minor deviation, the County maintains the option to award to that Vendor if it determines the performance is not adversely affected by the exception.

M. APPROVED EQUALS

1. In all specifications where a material or article is defined by describing a proprietary product or by using the name of a Vendor or manufacturer, it can be assumed that an approved equal can be substituted.
2. The use of a named product is an attempt to set a particular standard of quality and type that is familiar to the County. Such references are not intended to be restrictive.

3. However, the County shall decide if a product does in fact meet or exceed the quality of the specifications listed in the solicitation. It shall be the responsibility of the Vendor that claims his product is an equal to provide documentation to support such a claim.

N. DELIVERY

1. All items shall be delivered F.O.B. destination and delivery costs and charges included in the bid unless otherwise stated in the specifications or bid form.

O. INSURANCE

1. If required by the General Conditions or Terms and Conditions, the Successful Vendor shall provide the County with Certificates of Insurance within fifteen calendar days of bid award notification evidencing the required coverage.
2. Successful Vendor must provide Certificates of Insurance before commencing work in connection with the Contract.

P. BID EVALUATION

1. Bid tabulations will be posted on the County website at <https://www.co.worcester.md.us/commissioners/bids>. Click on the Expired Bids & Results tab and find the bid tabulation for the bid you are interested in. Bid tabulations will be posted as soon as reasonably possible after the Bid opening.

END OF SECTION

SECTION III: GENERAL CONDITIONS

A. DRAWINGS AND SPECIFICATIONS

1. Should any detail be omitted from the drawings or specifications, or should any errors appear in either, it shall be the duty of the Successful Vendor to notify the County's designated construction inspector.
2. In no case shall the Successful Vendor proceed with the work without notifying and receiving definite instructions from the County. Work wrongly constructed without such notification shall be corrected by the Successful Vendor at his own cost.

B. MATERIALS, SERVICES AND FACILITIES

1. It is understood that, except as otherwise specifically stated in the Bid Documents, the Successful Vendor will provide and pay for all materials, labor, tools, equipment, water, light, power and transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.
2. Materials and equipment will be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work will be located so as to facilitate prompt inspection.
3. Manufactured articles, materials, and equipment will be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.
4. Materials, supplies and equipment will be in accordance with samples submitted by the Successful Vendor and approved by the County.

C. INSPECTION AND TESTING

1. All materials and equipment used in the construction of the Work will be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Bid Documents.
2. The County or its representatives may, at any time, enter upon the work and the premises used by the Successful Vendor, and the Successful Vendor shall provide proper and safe facilities to secure convenient access to all parts of the work, and all other facilities necessary for inspection, as may be required.
3. The County will appoint such persons as deemed necessary to properly inspect the materials furnished or to be furnished, and the work done under the contract and to see that the same strictly corresponds with the drawings and specifications. All such materials and workmanship shall be subject to approval of the County. Approval or acceptance of payment shall not be misconstrued as approval of items or work not in conformance with specifications and drawings nor shall it prevent the rejection of said work or materials at any time thereafter during the existence of the contract, should said work or materials be found to be defective, or not in accordance with the requirements of the contract.
4. Work and material will be inspected promptly, but if for any reason should a delay occur, the Successful Vendor shall have no claim for damages or extra compensation.
5. The Successful Vendor shall pay for all inspection costs necessary to complete the work which may be incurred to comply with the requirements of any agency other than the County, such as a railroad, public service utility company, or any other governmental agency or any other agency whose jurisdiction affects the work in any manner unless otherwise specified herein.

D. APPROVAL OF SUBSTITUTION OF MATERIALS

1. Samples of materials shall be submitted by the Successful Vendor for approval before such materials are ordered from the manufacturers or distributors and shall be approved by the County before actual work is begun.
2. It is the intention of these specifications to permit all vendors bidding on this work to secure the fullest amount of competition on the various materials and specialties names herein. Wherever a material or article is defined by describing a proprietary product or by using the name of a vendor or manufacturer, the term or approved equal shall be presumed to be implied unless otherwise stated.

E. PROTECTION OF WORK, PROPERTY AND PERSONS

1. Successful Vendor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Successful Vendor will take all necessary precautions and programs in connection with the Work. Successful Vendor will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to, all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
2. Successful Vendor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. Successful Vendor will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. Successful Vendor will notify owners of adjacent utilities when progress of the Work may affect them. The Successful Vendor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by Successful Vendor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable.
3. In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Successful Vendor, without special instruction or authorization from the County, will act to prevent threatened damage, injury or loss. Successful Vendor will give the County prompt Written Notice of any significant changes in the Work or deviations from the Bid Documents caused thereby, and a Change Order will thereupon be issued covering the changes and deviations involved.

F. BARRICADES, DANGER, WARNING AND DETOUR SIGNS

1. The Successful Vendor shall provide, erect and maintain all necessary barricades, sufficient red lights, flares, danger signals and signs, provide a sufficient number of watchmen and take all necessary precautions for the protection of the work and safety of the public.

G. LICENSES AND PERMITS

1. The Successful Vendor shall have all necessary licenses required to do the work and give all notices and obtain and pay all necessary permits required by local laws and regulations for building.
2. State and Federal permits (if applicable) to undertake work have been obtained by the County and accompany these specifications.

H. SUPERVISION

1. The Successful Vendor shall maintain, at all times during the progress of work, a competent and experienced supervisor who shall represent the Successful Vendor, and all directions given to him shall be binding. Important decisions regarding directions, if requested by the supervisor, shall be confirmed in writing.
2. Supervision by the County or its representative does not relieve the Successful Vendor of responsibility for defective work executed under the direct control of the Successful Vendor. Responsibility for defective work rests upon the Successful Vendor, whether discovered by the County prior to final payment or subsequent thereto.

I. CLEAN UP

1. Upon completion of the items within a given location as specified and before monthly estimates will be paid, the construction area and all other areas occupied by the Successful Vendor during the construction of said Contract shall be cleaned of all surplus and discarded materials, bracing, forms, rubbish and temporary structures that were placed there by the Successful Vendor.
2. Disposal of the aforementioned shall be the responsibility of the Successful Vendor.

J. CHANGES IN WORK

1. The County, without invalidating the contract, may order extra work or make changes by altering, adding or deducting from the work with the contract sum being adjusted accordingly.
2. All such work shall be executed under the conditions of the original contract, except that any claim for the extension of time caused thereby shall be adjusted at the time of ordering such change.
3. The value of any such extra work or change shall be determined in one or more of the following ways:
 - a. By estimate and acceptance of lump sum.
 - b. By unit prices named in the contract or subsequently agreed upon.

K. TIME FOR COMPLETION

1. The Work contemplated under this Contract shall be considered as continuous and be completed within the timeframe(s) state in the EJCDC documents included here within.
2. The Successful Vendor will be allowed to work during the hours stated in EJCDC C-800 Section 7.03
3. The Successful Vendor will not be permitted to work on holidays observed by Worcester County or the State of Maryland or on Sundays unless otherwise authorized in writing.
4. In case of an emergency which may require that work be done on Saturdays, Sundays, and Holidays, the Successful Vendor shall request permission of the County to do so. If, in the opinion of the County, the emergency is bonafide, permission may be granted to the Successful Vendor to work such hours as may be determined are necessary by the County. Also, if in the opinion of the County a bonafide emergency exists, the Successful Vendor may be directed to work such hours as may be necessary whether or not the Successful Vendor requests permission to do so.
5. The Successful Vendor shall pay the County for all costs incurred for inspection services required for work permitted during holidays, weekends or in excess of eight hours per day.

L. CORRECTION OF WORK

1. The Successful Vendor will promptly remove from the premises all Work rejected by the County for failure to comply with the Bid Documents, whether incorporated in the construction or not,

and the Successful Vendor will promptly replace and re-execute the Work in accordance with the Bid Documents and without expense to the County and will bear the expense of making good all Work of other Vendors destroyed or damaged by such removal or replacement.

2. All removal and replacement Work will be done at the Successful Vendor's expense. If the Successful Vendor does not act to remove such rejected Work within ten days after receipt of Written Notice, the County may remove such Work and store the materials at the expense of the Successful Vendor.

M. CONSTRUCTION SAFETY AND HEALTH STANDARDS

1. It is a condition of this contract, and shall be made a condition of each sub-contract entered into pursuant to this contract, that the Successful Vendor and any sub-contractor shall not require any laborer or mechanic employed in performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under construction safety and health standards (Title 29, Code of Federal Regulations, Part 1926, formerly Part 1518, as revised from time to time, promulgated by the United States Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standard Act.) (83 Stat. 96).
2. Failure of Worcester County to inform the Successful Vendor of safety violations will not release the Successful Vendor of his responsibilities.

N. BID BOND

1. Bid Documents must be accompanied by a Bid Bond if the Vendor's total Bid amount exceeds \$100,000, payable to the County for five percent of the total amount of the bid. After the analysis of the Bid Documents the County will return Bid Bonds to all Vendors except the three lowest Responsive and Responsible Vendors. After execution of the Contract, and receipt, execution, and approval of the Successful Vendor's Payment and Performance bond, the Bid Bonds will be returned. A certified check may be used in lieu of a Bid Bond.
2. The County, at its discretion, may consider a Vendor in default if the Vendor fails to execute the Contract, in which the County will retain said Bid Bond.

O. PERFORMANCE AND PAYMENT BONDS

1. The Successful Vendor will be required to provide the County with a Performance Bond and Payment Bond if the total Contract amount exceeds \$100,000, each in the amount of one hundred percent of the Contract Price, with a corporate surety approved by the County for the faithful performance of the Contract.
2. The Successful Vendor will within fourteen calendar days after the receipt of the Contract furnish the County with a Performance Bond and Payment Bond in penal sums equal to the amount of the Contract Price, conditioned upon the performance by the Successful Vendor of all undertakings, covenants, terms, conditions and agreements of the Bid Documents, and upon the prompt payment by the Successful Vendor to all persons supplying labor and materials in the prosecution of the Work provided by the Bid Document. Such Bonds will be executed by the Successful Vendor and corporate bonding company licensed to transact such business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Circular Number 570. The expense of these Bonds will be borne by the Successful Vendor. If at any time a surety on any such Bond is declared bankrupt or loses its right to do business in the State of Maryland or is removed from the list of surety companies accepted on federal bonds, Successful Vendor will within ten calendar days after

notice from the County to do so, substitute an acceptable Bond(s) in such form and sum and signed by such other surety or sureties as may be satisfactory to the County.

P. GUARANTEE

1. The Successful Vendor shall furnish the County with a one-year guarantee of workmanship and materials, beginning upon substantial completion and shall make good any defects which may occur during that period.
2. If any special guarantees in excess of the one-year period are specified by the manufacturer, these guarantees shall take precedence over the one-year period guarantee.
3. Upon completion of work, and before final payment or release of retainage, the Successful Vendor shall submit, and obtain from each subcontractor, material supplier and equipment manufacture general warranties and a notarized asbestos free guarantee.

END OF SECTION

REFERENCES

List three references for which the Vendor has provided Goods/Services similar to those requested in the Bid Document within the last 12-36 months. Include contact name, address, telephone number, email address and services provided.

Company Name:		Company Name:	
Type of Project:		Type of Project:	
Address:		Address:	
Town, State, Zip Code:		Town, State, Zip Code:	
Contact Person:		Contact Person:	
Telephone Number:		Telephone Number:	
Email:		Email:	
Date of Service:		Date of Service:	
Company Name:			
Type of Project:			
Address:			
Town, State, Zip Code:			
Contact Person:			
Telephone Number:			
Email:			
Date of Service:			

Sign for Identification

Printed Name

EXCEPTIONS

The undersigned hereby certifies that, except as listed below, or on separate sheets attached hereto, the enclosed Completed Bid Document covers all items as specified.

EXCEPTIONS:

(If none, write none) _____

How did you hear about this solicitation?

- ☐ Worcester County's Website
- ☐ eMaryland Marketplace Advantage (eMMA)
- ☐ Newspaper Advertisement
- ☐ Direct email
- ☐ Other _____

The vendor hereby acknowledges receipt of the following addenda.

<u>Number</u>	<u>Date</u>	<u>Initials</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

Sign for Identification

Printed Name

INDIVIDUAL PRINCIPAL

Vendor Name: _____

Signed By: _____ In the presence of: _____

Address of Vendor: _____ Town, State, Zip _____

Telephone No.: _____ Fax: _____ Email: _____

CO-PARTNERSHIP PRINCIPAL

Name of Co-Partnership: _____

Address: _____ Town, State, Zip _____

Telephone No.: _____ Fax: _____

Signed By: _____ In the presence of: _____
Partner Witness

Signed By: _____ In the presence of: _____
Partner Witness

Signed By: _____ In the presence of: _____
Partner Witness

CORPORATE PRINCIPAL

Name of Corporation: _____

Address: _____ Town, State, Zip _____

Telephone No.: _____ Fax: _____

Signed By: _____ In the presence of: _____
President Witness

Attest: _____
Corporate Secretary

Affix Corporate Seal

VENDOR'S AFFIDAVIT OF QUALIFICATION TO BID

I HEREBY AFFIRM THAT:

I, _____ am the _____
(Printed Name) (title)
and the duly authorized representative of the Vendor of
_____ whose address is
(name of corporation)

and that I possess the legal authority to make this affidavit on behalf of myself and the Vendor for which I am acting.

Except as described in paragraph 3 below, neither I nor the above Vendor, nor to the best of my knowledge and of its officers, directors or partners, or any of its employees directly involved in obtaining contracts with the State or any county, bi-county or multi-county agency, or subdivision of the State have been convicted of, or have pleaded nolo-contendere to a charge of, or have during the course of an official investigation or other proceeding admitted in writing or under oath acts or omissions which constitute, bribery, attempted bribery, or conspiracy to bribe under the provisions of Article 27 of the Annotated Code of Maryland or under the laws of any state or federal government (conduct prior to July 1, 1977 is not required to be reported).

(State "none" or, as appropriate, list any conviction, plea or admission described in paragraph 2 above, with the date, court, official or administrative body, the individuals involved and their position with the Vendor, and the sentence or disposition, if any.)

I acknowledge that this affidavit is to be furnished to the County, I acknowledge that, if the representations set forth in this affidavit are not true and correct, the County may terminate any Contract awarded and take any other appropriate action. I further acknowledge that I am executing this affidavit in compliance with section 16D of Article 78A of the Annotated Code of Maryland, which provides that certain persons who have been convicted of or have admitted to bribery, attempted bribery or conspiracy to bribe may be disqualified, either by operation of law or after a hearing, from entering into contracts with the State or any of its agencies or subdivisions.

I do solemnly declare and affirm under the penalties of perjury that the contents of this affidavit are true and correct.

Sign for Identification

Printed Name

NON-COLLUSIVE AFFIDAVIT

_____ being first duly sworn,
deposes and says that:

1. He/she is the _____, (Owner, Partner, Officer, Representative or Agent) of _____, the Vendor that has submitted the attached Bid Documents;
2. He/she is fully informed respecting the preparation and contents of the attached Bid Document and of all pertinent circumstances respecting such Bid Documents;
3. Such Bid Document is genuine and is not a collusive or sham Bid Document;
4. Neither the said Vendor nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, have in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Vendor, firm, or person to submit a collusive or sham Bid Document in connection with the Work for which the attached Bid Document has been submitted; or to refrain from bidding in connection with such Work; or have in any manner, directly or indirectly, sought by agreement or collusion, or communication, or conference with any Vendor, firm, or person to fix the price or prices in the attached Bid Document or of any other Vendor, or to fix any overhead, profit, or cost elements on the Bid Document price or the Bid Document price of any other Vendor, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any disadvantage against (Recipient), or any person interested in the Work;
5. The price or prices quoted in the attached Bid Document are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Vendor or any other of its agents, representatives, owners, employees or parties in interest, including this affiant.

Signed, sealed and delivered in the presence of:

Witness

Witness

By: _____
Signature

Printed Name

Title

EXHIBIT A

WORCESTER COUNTY MARYLAND STANDARD TERMS AND CONDITIONS

The provisions below are applicable to all Worcester County ("County") contracts. These provisions are not a complete agreement. These provisions must be attached to an executed document that identifies the work to be performed, compensation, term, incorporated attachments, and any special conditions ("Contract"). If the Standard Terms and any other part of the Contract conflict, then the Standard Terms will prevail.

1. **Amendment.** Amendments to the Contract must be in writing and signed by the parties.
2. **Bankruptcy.** If a bankruptcy proceeding by or against the Contractor is filed, then:
 - a. The Contractor must notify the County immediately; and
 - b. The County may cancel the Contract or affirm the Contract and hold the Contractor responsible for damages.
3. **Compliance with Law.** Contractor must comply with all applicable federal, state, and local law. Contractor is qualified to do business in the State of Maryland. Contractor must obtain, at its expense, all licenses, permits, insurance, and governmental approvals needed to perform its obligations under the Contract.
4. **Contingent Fee Prohibition.** The Contractor has not directed anyone, other than its employee or agent, to solicit the Contract and it has not promised to pay anyone a commission, percentage, brokerage fee, contingent fee, or other consideration contingent on the making of the Contract.
5. **Counterparts and Signature.** The Contract may be executed in several counterparts, each of which may be an original and all of which will be the same instrument. The Contract may be signed in writing or by electronic signature, including by email. An electronic signature, a facsimile copy, or computer image of the Contract will have the same effect as an original signed copy.
6. **Exclusive Jurisdiction.** All legal proceedings related to this Contract must be exclusively filed, tried, and maintained in either the District Court of Maryland for Worcester County, Maryland or the Circuit Court of Worcester County, Maryland. The parties expressly waive any right to remove the matter to any other state or federal venue and waive any right to a jury trial.
7. **Force Majeure.** The parties are not responsible for delay or default caused by fire, riot, acts of God, County-declaration-of-emergency, or war beyond their reasonable control. The parties must make all reasonable efforts to eliminate a cause of delay or default and must, upon cessation, diligently pursue their obligations under the Contract.
8. **Governing Law.** The Contract is governed by the laws of Maryland and the County.
9. **Indemnification.** The Contractor must indemnify the County and its agents from all liability, penalties, costs, damages, or claims (including attorney's fees) resulting from personal injury, death, or damage to property that arises from or is connected to the performance of the work or failure to perform its obligations under the Contract. All indemnification provisions will survive the expiration or termination of the Contract.

10. Independent Contractor.

- a. Contractor is an “Independent Contractor”, not an employee. Although the County may determine the delivery schedule for the work and evaluate the quality of the work, the County will not control the means or manner of the Contractor’s performance.
- b. Contractor is responsible for all applicable taxes on any compensation paid under the Contract. Contractor is not eligible for any federal Social Security, unemployment insurance, or workers’ compensation benefits under the Contract.
- c. Contractor must immediately provide the County notice of any claim made against Contractor by any third party.

11. Insurance Requirements.

- a. Contractor must have Commercial General Liability Insurance in the amounts listed below. The insurance must include coverage for personal injury, discrimination, and civil rights violation claims. All insurance must name County, its employees, and agents as “ADDITIONAL INSURED”. A copy of the certificate of insurance must be filed with the County before the Contract is executed, providing coverage in the amount of \$1,000,000 per occurrence, \$2,000,000 general aggregate, and \$500,000 for property damage.
- b. Contractor must have automobile insurance on all vehicles used in the Contract to protect Contractor against claims for damages resulting from bodily injury, including wrongful death, and property damage that may arise from the operations in connection with the Contract. All insurance must name County, its employees, and agents as “ADDITIONAL INSURED”.
- c. Contractor must provide the County with a certification of Workers’ Compensation Insurance, with employer’s liability in the minimum amount required by Maryland law in effect for each year of the Contract.
- d. All insurance policies must have a minimum 30 days’ notice of cancellation. The County must be notified immediately upon cancellation.
- e. When insurance coverage is renewed, Contractor must provide new certificates of insurance prior to expiration of current policies.

12. Nondiscrimination. Contractor must not discriminate against any worker, employee, or applicant because of religion, race, sex, age, sexual orientation, physical or mental disability, or perceived disability. This provision must be incorporated in all subcontracts related to the Contract.

13. Ownership of Documents; Intellectual Property.

- a. All documents prepared under the Contract must be available to the County upon request and will become the exclusive property of the County upon termination or completion of the services. The County may use the documents without restriction or without additional compensation to the Contractor. The County will be the owner of the documents for the purposes of copyright, patent, or trademark registration.
- b. If the Contractor obtains, uses, or subcontracts for any intellectual property, then it must provide an assignment to the County of ownership or use of the property.
- c. The Contractor must indemnify the County from all claims of infringement related to

the use of any patented design, device, materials, or process, or any trademark or copyright, and must indemnify the County, its officers, agents, and employees with respect to any claim, action, costs, or infringement, for royalties or user fees, arising out of purchase or use of materials, construction, supplies, equipment, or services covered by the Contract.

14. **Payments.** Payments to the Contractor under the Contract will be within 30 days of the County's receipt of a proper invoice from the Contractor. If an invoice remains unpaid 45 days after the invoice was received, interest will accrue at 5% per year.
15. **Records.** Contractor must maintain fiscal records relating to the Contract in accordance with generally accepted accounting principles. All other relevant records must be retained by Contractor and kept accessible for at least three years after final payment, termination of the Contract, or until the conclusion of any audit, controversy, or litigation related to the Contract. All subcontracts must comply with these provisions. County may access all records of the Contractor related to the Contract.
16. **Remedies.**
 - a. **Corrections of errors and omissions.** Contractor must perform work necessary to correct errors and omissions in the services required under the Contract, without undue delays and cost to the County. The County's acceptance will not relieve the Contractor of the responsibility of subsequent corrections of errors.
 - b. **Set-off.** The County may deduct from any amounts payable to the Contractor any back-charges, penalties, or damages sustained by the County, its agents, or employees caused by Contractor's breach. Contractor will not be relieved of liability for any costs caused by a failure to satisfactorily perform the services.
 - c. **Cumulative.** These remedies are cumulative and without waiver of any others.
17. **Responsibility of Contractor.**
 - a. The Contractor must perform the services with the standard of care, skill, and diligence normally provided by a Contractor in the performance of services similar the services.
 - b. Notwithstanding any review, approval, acceptance, or payment for the services by the County, the Contractor will be responsible for the accuracy of any work, design, drawings, specifications, and materials furnished by the Contractor under the Contract.
 - c. If the Contractor fails to conform with subparagraph (a) above, then it must, if required by the County, perform at its own expense any service necessary for the correction of any deficiencies or damages resulting from the Contractor's failure. This obligation is in addition to any other remedy available to the County.
18. **Severability/Waiver.** If a court finds any term of the Contract to be invalid, the validity of the remaining terms will not be affected. The failure of either party to enforce any term of the Contract is not a waiver by that party.
19. **Subcontracting or Assignment.** The Contractor may not subcontract or assign any part of the Contract without the prior written consent of the County. The County may withhold consent for any reason the County deems appropriate.

20. **Termination.** If the Contractor violates any provision of the Contract, the County may terminate the Contract by written notice. All finished or unfinished work provided by the Contractor will, at the County's option, become the County's property. The County will pay the Contractor fair compensation for satisfactory performance that occurred before termination less the amount of damages caused by the Contractor's breach. If the damages are more than the compensation payable to the Contractor, the Contractor will remain liable after termination and the County can affirmatively collect damages.
21. **Termination of Contract for Convenience.** Upon written notice, the County may terminate the Contract when the County determines termination is in the County's best interest. Termination for convenience is effective on the date specified in the County's written notice. The County will pay for reasonable costs allocable to the Contract for costs incurred by the Contractor up to the date of termination. But the Contractor will not be reimbursed for any anticipatory profits that have not been earned before termination.
22. **Termination of Multi-year Contract.** If funds are not available for any fiscal period of the Contract after the first fiscal period, then the Contract will be terminated automatically as of the beginning of unfunded fiscal period. Termination will discharge the Contractor and the County from future performance of the Contract, but not from their rights and obligations existing at the time of termination.
23. **Third Party Beneficiaries.** The County and Contractor are the only parties to the Contract and are the only parties entitled to enforce its terms. Nothing in the Contract gives any benefit or right to third persons unless individually identified by name and expressly described as intended beneficiaries of the Contract.
24. **Use of County Facilities.** Contractor may only utilize County facilities that are needed to perform the Contract. County has no responsibility for the loss or damage to Contractor's personal property which may be stored within a County facility or on County property.
25. **Whole Contract.** The Contract, the Standard Terms, and attachments are the complete agreement between the parties and supersede all earlier agreements, proposals, or other communications between the parties relating to the subject matter of the Contract.

END OF SECTION

***The preceding sections contain Worcester County's standard bid specifications. Should there be any discrepancies between this information and the specifications outlined by the Engineers Joint Contract Documents Committee (EJCDC) below, the EJCDC specifications will take precedence.**

SECTION B

ADVERTISEMENT FOR BIDS
WORCESTER COUNTY COMMISSIONERS
WORCESTER COUNTY, MARYLAND
Ocean Pines Biosolids Dewatering Project

General Notice

Worcester County Commissioners (Owner) is requesting Bids for the construction of the following Project:

Ocean Pines Biosolids Dewatering Project
0085D027

Bids for the construction of the Project will be received at the Worcester County Public Works located at 1 West Market Street, Snow Hill, MD, until 27 August 2026 at 3:30 PM local time. At that time the Bids received will be publicly opened and read.

The Project includes the following Work:

All work designated in the Contract Documents including the Specifications and as shown on the Plans and generally consists of the installation of a new biosolids dewatering building, sludge holding tank, dewatering belt press, and other miscellaneous related work as indicated within the contract documents. Work includes furnishing all equipment, material, and labor for the work described in the contract document drawings and specifications.

Bids are requested for the following Contract: Ocean Pines Biosolids Dewatering Project, #0085D027

The Project has an expected duration of 270 days.

Obtaining the Bidding Documents:

Information and Bidding Documents for the Project can be found at the following designated website:

<https://www.co.worcester.md.us/commissioners/bids>

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to monitor the designated website as a plan holder, even if Bidding Documents are obtained from a plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with addenda, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

Pre-bid Conference

A pre-bid conference for the Project will be held on August 6, 2026 at 10:00AM at 1000 Shore Lane, Berlin, MD 21811. Attendance at the pre-bid conference is encouraged but not required.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

Domestic Preference:

None

The following waivers apply to this Contract:

None

This Advertisement is issued by:

Owner: Worcester County

Commissioners By: Edward Welch

Title: Procurement Officer

Date: TBD, 2026

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.
 - B. ***Domestic Preference – None***

ARTICLE 2—BIDDING DOCUMENTS

- 2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.
- 2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.
- 2.03 Bidder may register as a plan holder and obtain complete sets of Bidding Documents, in the number and format stated in the Advertisement or invitation to bid, from the Issuing Office. Bidders may rely that sets of Bidding Documents obtained from the Issuing Office are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.
- 2.04 *Electronic Documents*
- A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.
 - 1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader Version 10 or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.
 - B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and

responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

- 3.01 *Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:*
- A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.
 - B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.
 - C. Bidder's state or other contractor license number, if applicable.
 - D. Subcontractor and Supplier qualification information.
 - E. Other required information regarding qualifications.
- 3.02 ~~***A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.***~~
- 3.03 *No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.*

ARTICLE 4—PRE-BID CONFERENCE

- 4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.
- 4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

- 5.01 *Site and Other Areas*
- A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.
- 5.02 *Existing Site Conditions*
- A. ~~***Subsurface and Physical Conditions; Hazardous Environmental Conditions***~~

1. ~~The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:~~
 - a. ~~Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.~~
 - b. ~~Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.~~
 - c. ~~Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.~~
 - d. ~~Technical Data contained in such reports and drawings.~~
 2. ~~Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.~~
 3. ~~If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.~~
 4. ~~Geotechnical Baseline Report/Geotechnical Data Report: The Bidding Documents contain a Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).~~
 - a. ~~As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.~~
 - b. ~~The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.~~
 - c. ~~Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.~~
 - d. ~~As set forth in the Supplementary Conditions, the GDR is a Contract Document containing data prepared by or for the Owner in support of the GBR.~~
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the

presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-related Documents*

- A. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

- A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.
- B. A Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference.
- C. **Deleted.** A Site visit is scheduled for ~~[designate, date, time and location]~~. Maps to the Site will be made available upon request.
- D. Bidders visiting the Site are required to arrange their own transportation to the Site.
- E. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the County Director of Public Works for visiting the Site. Bidder must conduct the required Site visit during normal working hours.
- F. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- G. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.
- H. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.
- I. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

- A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

- A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for

such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

- A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder’s examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.
- B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

- 7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.
- 7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:
 - A. Mr. Edward Welch, Procurement Officer
Worcester County Administration
One West Market Street, Room
1103 Snow Hill, Maryland 21863
nrice@co.worcester.md.us
- 7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.
- 7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5% percent of Bidder’s maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents. **Bid security must be at least 5% of the Bidder’s maximum Bid price.**
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and

furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.
- 9.02 ~~Bidder must set forth in the Bid the time by which Bidder must achieve Substantial Completion, subject to the restrictions established in Paragraph 13.07 of these Instructions. The Owner will take Bidder's time commitment regarding Substantial Completion into consideration during the evaluation of Bids, and it will be necessary for the apparent Successful Bidder to satisfy Owner that it will be able to achieve Substantial Completion within the time such Bidder has designated in the Bid. [If applicable include the following: Bidder must also set forth in the Bid its commitments regarding the achievement of Milestones and readiness for final payment.] The Successful Bidder's time commitments will be entered into the Agreement or incorporated in the Agreement by reference to the specific terms of the Bid.~~

Deleted

- 9.03 **Deleted.** ~~Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.~~

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

- 10.01 ~~The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.~~

Deleted

- 10.02 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been

received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. **Each such request shall include the Manufacturer's Certification for Compliance with AIS. Refer to the Manufacturer's Certification form provided in these construction Contract Documents.** The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner. **Substitutes and "or-equal" materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.05 and 7.06 of the General Conditions after the Effective Date of the Contract. Each such request shall include Manufacturer's Certification letter to document compliance with Domestic Preference requirements. Refer to Manufacturer's Certification Letter provided in these Contract Documents.**

- 11.03 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 11.01 ~~A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.~~

Deleted

- 11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:
- A. Public Utility Work
 - B. Paving Work
 - C. Licensed Plumbing Work
 - D. Well Abandonment Work
- 11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.
- 11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security

of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

11.05 – The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.07A.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

- A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
- B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder’s name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

- 12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.
- 12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

- A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

13.02 *Base Bid with Alternates*

- A. Bidders must submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.
- B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

13.03 *Sectional Bids*

- A. Bidders may submit a Bid on any individual section or any combination of sections, as set forth in the Bid Form.
- B. Submission of a Bid on any section signifies Bidder's willingness to enter into a Contract for that section alone at the price offered.
- C. If Bidder submits Bids on individual sections and a Bid based on a combination of those sections, such combined Bid need not be the sum of the Bids on the individual sections.
- D. Bidders offering a Bid on one or more sections must be capable of completing the Work covered by those sections within the time period stated in the Agreement.

13.04 *Cost-Plus-Fee Bids*

- A. ~~Bidders must submit a Bid on the Contractor's fee, which must be in addition to compensation for Cost of the Work. Such fee must be either (1) a fixed fee, (2) percentages of specified categories of costs, or (3) a percentage applicable to the Cost of the Work as a whole, as set forth in the Bid Form.~~
- B. ~~If the Contractor's fee, as set forth in the Bid Form, is to be based on percentages of categories of cost, or on a percentage applicable to the Cost of the Work as a whole, then Bidders must enter a maximum amount limiting the total fee if required by the Bid Form to do so.~~
- C. ~~Bidders must submit a Bid on the Guaranteed Maximum Price, setting a maximum amount on the compensable Cost of the Work plus Contractor's fee, if required by the Bid Form to do so.~~

Deleted

13.05 Unit Price

- A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The “Bid Price” (sometimes referred to as the extended price) for each unit price Bid item will be the product of the “Estimated Quantity”, which Owner or its representative has set forth in the Bid Form, for the item and the corresponding “Bid Unit Price” offered by the Bidder. The total of all unit price Bid items will be the sum of these “Bid Prices”; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

13.06 Allowances

- A. For cash allowances the Bid price must include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

13.07 ~~Price-Plus-Time Bids~~

- A. ~~The Owner will consider the time of Substantial Completion commitment made by the Bidder in the comparison of Bids.~~
- B. ~~Bidder must designate the number of days required to achieve Substantial Completion of the Work and enter that number in the Bid Form as the total number of calendar days to substantially complete the Work.~~
- C. ~~The total number of calendar days for Substantial Completion designated by Bidder must be less than or equal to a maximum of [number], but not less than the minimum of [number]. If Bidder purports to designate a time for Substantial Completion that is less than the allowed minimum, or greater than the allowed maximum, Owner will reject the Bid as nonresponsive.~~
- D. ~~The Agreement as executed will contain the Substantial Completion time designated in Successful Bidder's Bid, and the Contractor will be assessed liquidated damages at the rate stated in the Agreement for failure to attain Substantial Completion within that time.~~
- E. ~~Bidder must also designate the time in which it will achieve Milestones, and achieve readiness for final payment. Such time commitments must be consistent with the “Time of Substantial Completion” to which Bidder commits. The Agreement as executed will contain, as binding Contract Times, Successful Bidder's time commitments regarding Milestones, as applicable, and readiness for final payment.~~

Deleted

ARTICLE 14—SUBMITTAL OF BID

- 14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid

security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

- 14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.
- 14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

- 15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid,

and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

- 16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.
- 18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.
- 18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.
- 18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.
- 18.05 *Evaluation of Bids*
- A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
 - B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner will announce to all bidders a “Base Bid plus alternates” budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.
 - C. For determination of the apparent low Bidder(s) when sectional bids are submitted, Bids will be compared on the basis of the aggregate of the Bids for separate sections and the Bids for combined sections that result in the lowest total amount for all of the Work.

- D. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.
- E. ~~For the determination of the apparent low Bidder when cost-plus-fee bids are submitted, Bids will be compared on the basis of the Guaranteed Maximum Price set forth by Bidder on the Bid Form.~~

Deleted

- F. ~~Bid prices will be compared after adjusting for differences in time of Substantial Completion (total number of calendar days to substantially complete the Work) designated by Bidders. The adjusting amount will be determined at the rate set forth in the Agreement for liquidated damages for failing to achieve Substantial Completion, or such other amount that Owner has designated in the Bid Form.~~
 - 1. ~~The method for calculating the lowest bid for comparison will be the summation of the Bid price shown in the Bid Form plus the product of the Bidder specified time of Substantial Completion in calendar days times the rate for liquidated damages [or other Owner designated daily rate] in dollars per day.~~
 - 2. ~~This procedure is only used to determine the lowest bid for comparison and contractor selection purposes. The Contract Price for compensation and payment purposes remains the Bid price shown in the Bid Form.~~

Deleted

- 18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.
- 18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

- 19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.
- 19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

- 20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful

Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

- 21.01 Owner is exempt from Maryland State sales and use taxes on materials and equipment to be incorporated in the Work. The County will provide a tax exemption certificate number. It is the responsibility of the Contractor to determine what costs are tax exempt. Said taxes must not be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information.

ARTICLE 22—CONTRACTS TO BE ASSIGNED

ARTICLE 23 – FEDERAL REQUIREMENTS

- 23.01 If the contract price is in excess of \$100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) apply.
- 23.02 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

- 1.01 This Bid is submitted to: County Commissioners of Worcester County, One West Market Street Room 1103, Snow Hill, Maryland 21863
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

- 2.01 The following documents are submitted with and made a condition of this Bid:
 - A. Required Bid security;
 - B. List of Proposed Subcontractors;
 - C. List of Proposed Suppliers;
 - D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;
 - E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;
 - F. Required Bidder Qualification Statement with supporting data; ~~and~~
 - G. **If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in the Supplementary Conditions of the Construction Contract (EJCDC C-800);**
 - H. **If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);**
 - I. **If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q Exhibit A-1, Certification for Contracts, Grants, and Loans.**

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 Unit Price Bids

A. Bidder will perform the following Work at the indicated unit prices:

OCEAN PINES BIOSOLIDS DEWATERING PROJECT						
Item No.	Description	SIZE OR DEPTH	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
1.	Mobilization, Bonds, Insurance, and Demobilization (maximum 3% of Base Bid)	--	LS	1	--	\$
2.	Furnish and Install Oceans Pines Biosolids Dewatering Project Complete	--	LS	1	--	\$
Contingencies						
3.	Furnish and Place Select Fill from Off-site Source	--	CY	500	\$	\$
4.	Furnish and Place No. 57 Gravel	--	CY	200	\$	\$
5.	Test Pitting	--	CY	500	\$	\$
6.	Furnish and Place Misc. 4,000 PSI Concrete	--	CY	100	\$	\$
Total of All Lump Sum & Unit Price Bid Items: \$						
Bid Add Alternate						
7.	Furnish and Install Conveyor Extension Complete	--	LS	1	--	\$
Total of All Bid Add Alternates: \$						

B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and
2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

3.02 Total Bid Price (Lump Sum and Unit Prices)

Total Bid Price (Total of all Lump Sum and Unit Prices)	\$

TOTAL BID PRICE IN WORDS (Total of all Lump Sum and Unit Prices)

Total Bid Price (Total of all Lump Sum, Unit Price, and Bid Add Alternates)	\$

TOTAL BID PRICE IN WORDS (Total of all Lump Sum, Unit Prices, and Bid Alternates)

ARTICLE 4—BASIS OF BID—COST-PLUS FEE – DELETED

ARTICLE 5—PRICE-PLUS-TIME BID - DELETED

ARTICLE 6—TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 ~~Bidder agrees that the Work will be substantially complete on or before [Bidder inserts date], and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before [Bidder inserts date].~~

Deleted

6.03 ~~Bidder agrees that the Work will be substantially complete within [Bidder inserts number] calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within [Bidder inserts number] calendar days after the date when the Contract Times commence to run.~~

Deleted

6.04 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7—BIDDER’S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

7.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

7.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 8—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

8.01 *Bidder’s Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work, **including all Domestic Preference requirements.**
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder’s (Contractor’s) safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.
12. Bidder is familiar with all laws and regulations that may affect cost, progress, and performance of the work, including BABAA requirements.

8.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
 - a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
 - b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
 - c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.
 - d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

(typed or printed name of organization)

By:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

Address for giving notices:

Bidder's Contact:

Name:

(typed or printed)

Title:

(typed or printed)

Phone:

Email:

Address:

Bidder's Contractor License No.: (if applicable)

BID BOND (PENAL SUM FORM)

Bidder Name: Address <i>(principal place of business)</i> :	Surety Name: Address <i>(principal place of business)</i> :
Owner Name: County Commissioners of Worcester County Address <i>(principal place of business)</i> : One West Market Street Room 1103, Snow Hill, Maryland 21863	Bid Project <i>(name and location)</i> : Ocean Pines Biosolids Dewatering Project, Worcester County Bid Due Date: TBD, 2026
Bond Penal Sum: Date of Bond:	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder	Surety
_____ <i>(Full formal name of Bidder)</i>	_____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature) (Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<i>Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.</i>	

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
1.			
2.			
3.			
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?		☐ Yes ☐ No ☐ Pending	

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

- 1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	\$
Name:		Title:	

ARTICLE 2—LICENSING

- 2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

- 3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		
☐ HUBZone Business (Historically Underutilized) Business		
☐ Other		
☐ None		

ARTICLE 4—SAFETY

- 4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

- 4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

- 5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

ARTICLE 6—SURETY INFORMATION

- 6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

- 7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?		☐ Yes ☐ No	
Does provider have an A.M. Best Rating of A-VII or better?		☐ Yes ☐ No	
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

- A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.
- B. Diverse Business Certifications if required by Paragraph 3.01.
- C. Certification of Business's safety performance if required by Paragraph 4.02.
- D. Financial statements as required by Paragraph 5.01.

- E. Attachments providing additional information as required by Paragraph 8.02.
- F. Schedule A (Current Projects) as required by Paragraph 8.03.
- G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.
- H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.
- I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business:

(typed or printed name of organization)

By:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Address:

Phone:

Email:

Schedule A—Current Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. I ☐ have ☐ have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.
2. If I have participated in such a contract or subcontract, I ☐ have, ☐ have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.
☐ If the proposed contract is for \$50,000 or more: or ☐ if the proposed nonconstruction contract is for \$50,000 or more and I have 50 or more employees, I also represent that:
3. I ☐ have, ☐ have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
4. If I have participated in such a contract or subcontract, ☐ I have, ☐ have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms 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, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

A federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a currently valid OMB Control Number. The OMB Control Number for this information collection is 0575-0201. Public reporting for this collection of information is estimated to be approximately 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information. All responses to this collection of information are voluntary. However, in order to obtain or retain a benefit, the information in this form is required 7 CFR 1901-E. Rural Development has no plans to publish information collected under the provisions of this program. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Information Collection Clearance Officer, Rural Development Innovation Center, Regulations Management Division at ICRMTRRequests@usda.gov.

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR
CERTIFICATIONS OF NON-SEGREGATED FACILITIES**

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

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

Date _____

(Signature of Bidder or Prospective Contractor)

Address (including Zip Code)

U.S. DEPARTMENT OF AGRICULTURE

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

Signature(s)

Date

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," without modification, in all lower tier covered transaction and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

(name)

(date)

(title)

oOo

NOTICE OF AWARD

Date of Issuance:

Owner: County Commissioners of Worcester County Owner's Project No.:
Engineer: Davis, Bowen & Friedel Inc. Engineer's Project 0085D027
Project: Ocean Pines Biosolids Dewatering Project
Contract Name: Ocean Pines Biosolids Dewatering Project
Bidder:
Bidder's Address:

You are notified that Owner has accepted your Bid dated **TBD, 2026** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

All work designated in the Contract Documents including the Specifications and as shown on the Plans and generally consists of the installation of a new biosolids dewatering building, sludge holding tank, dewatering belt press, and other miscellaneous related work as indicated within the contract documents. Work includes furnishing all equipment, material, and labor for the work described in the contract document drawings and specifications.

The Contract Price of the awarded Contract is \$[**Contract Price**]. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

[**Number of copies sent**] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [**number of copies sent**] counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **Worcester County Commissioners**

By (*signature*):

Name (*printed*):

Title:

Copy: Engineer

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between County Commissioners of Worcester County ("Owner") and _____ ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

- 1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: **All work designated in the Contract Documents including the Specifications and as shown on the Plans and generally consists of the installation of a new biosolids dewatering building, sludge holding tank, dewatering belt press, and other miscellaneous related work as indicated within the contract documents. Work includes furnishing all equipment, material, and labor for the work described in the contract document drawings and specifications.**

ARTICLE 2—THE PROJECT

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **All work designated in the Contract Documents including the Specifications and as shown on the Plans and generally consists of the installation of a new biosolids dewatering building, sludge holding tank, dewatering belt press, and other miscellaneous related work as indicated within the contract documents. Work includes furnishing all equipment, material, and labor for the work described in the contract document drawings and specifications.**

ARTICLE 3—ENGINEER

- 3.01 The Owner has retained **Davis, Bowen & Friedel Inc.** ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.
- 3.02 The part of the Project that pertains to the Work has been designed by the Engineer.

ARTICLE 4—CONTRACT TIMES

- 4.01 *Time is of the Essence*
- A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.
- 4.02 *Contract Times: Days*
- A. The Work will be substantially complete within **270** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 30 days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. *Substantial Completion*: Contractor shall pay Owner \$500.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
 2. *Completion of Remaining Work*: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$500.00 for each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion, and final completion are not additive, and will not be imposed concurrently.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.
- C. ~~*Bonus*: Contractor and Owner further recognize the Owner will realize financial and other benefits if the Work is completed prior to the time specified for Substantial Completion. Accordingly, Owner and Contractor agree that as a bonus for early completion, Owner shall pay Contractor \$[number] for each day prior to the time specified above for Substantial Completion (as duly adjusted pursuant to the Contract) that the Work is substantially complete. The maximum value of the bonus will be limited to \$[number].~~

Deleted

4.06 *Special Damages*

- A. Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

- C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

- A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **10th** day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

- a. **95** percent of the value of the Work completed (with the balance being retainage).

- 1) ~~If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and~~

Deleted

- b. **95** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

- B. Upon Substantial Completion of the entire construction to be provided under the construction Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

- A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

- A. All amounts not paid when due will bear interest at the rate of **5** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

- A. The Contract Documents consist of all of the following:
 - 1. This Agreement.
 - 2. Bonds:
 - a. Performance bond (together with power of attorney).
 - b. Payment bond (together with power of attorney).
 - 3. General Conditions.
 - 4. Supplementary Conditions.
 - 5. Specifications as listed in the table of contents of the project manual (copy of list attached).
 - 6. Drawings (not attached but incorporated by reference) consisting of **[number]** sheets with each sheet bearing the following general title: **Ocean Pines Biosolids Dewatering Project**.
 - 8. Addenda (numbers _____ to _____ inclusive).
 - 9. Exhibits to this Agreement (enumerated as follows):
 - a. **No additional exhibits are available.**
 - 10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 - e. Warranty Bond, if any.
- B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

- C. There are no Contract Documents other than those listed above in this Article 7.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 Contractor's Representations

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
 - 1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
 - 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - 3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
 - 4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
 - 5.—Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
 - 6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
 - 7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
 - 8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
 - 9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of

discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:
 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner:

Contractor:

(typed or printed name of organization)

(typed or printed name of organization)

By:

(individual's signature)

By:

(individual's signature)

Date:

(date signed)

Date:

(date signed)

Name:

(typed or printed)

Name:

(typed or printed)

Title:

(typed or printed)

Title:

(typed or printed)

(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

(individual's signature)

Attest:

(individual's signature)

Title:

(typed or printed)

Title:

(typed or printed)

Address for giving notices:

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Title:

(typed or printed)

Address:

Address:

Phone:

Phone:

Email:

Email:

(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

License No.:

(where applicable)

State:

NOTICE TO PROCEED

Owner: County Commissioners of Worcester County Owner's Project No.: _____
Engineer: Davis, Bowen & Friedel Inc. Engineer's Project No.: 0085D027
Contractor: _____ Contractor's Project No.: _____
Project: Ocean Pines Biosolids Dewatering Project
Contract Name: Ocean Pines Biosolids Dewatering Project
Effective Date of Contract: _____

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The number of days to achieve Substantial Completion is **270** from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of **[date, calculated from commencement date above]**; and the number of days to achieve readiness for final payment is **30** from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **[date, calculated from commencement date above]**.

Before starting any Work at the Site, Contractor must comply with the following:

Contractor and their key subcontractors shall attend a pre-construction meeting and concur with the subsequent meeting minutes.

Owner: County Commissioners of Worcester County
By (signature): _____
Name (printed): _____
Title: _____
Date Issued: _____
Copy: Engineer

PERFORMANCE BOND

Contractor Name: Address <i>(principal place of business)</i> :	Surety Name: Address <i>(principal place of business)</i> :
Owner Name: County Commissioners of Worcester County Mailing address <i>(principal place of business)</i> : One West Market Street Room 1103, Snow Hill, Maryland 21863.	Contract Description <i>(name and location)</i> : Ocean Pines Biosolids Dewatering Project, Worcester County Contract Price: Effective Date of Contract:
Bond Bond Amount: Date of Bond: <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: ☐ None ☐ See Paragraph 16	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
 - 3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
 - 3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
 - 5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

- 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
- 6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
- 7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
 - 7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
 - 7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
- 8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
- 9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
- 10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
- 11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.
- 12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.
- 13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

- 14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
 - 14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
 - 14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
 - 14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows: None.

PAYMENT BOND

Contractor Name: Address <i>(principal place of business)</i> :	Surety Name: Address <i>(principal place of business)</i> :
Owner Name: County Commissioners of Worcester County Mailing address <i>(principal place of business)</i> : One West Market Street Room 1103, Snow Hill, Maryland 21863	Contract Description <i>(name and location)</i> : Ocean Pines Biosolids Dewatering Project, Worcester County Contract Price: Effective Date of Contract:
Bond Bond Amount: Date of Bond: <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: ☐ None ☐ See Paragraph 18	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
 - 5.1. Claimants who do not have a direct contract with the Contractor
 - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2. Pay or arrange for payment of any undisputed amounts.
 - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions
 - 16.1. *Claim*—A written statement by the Claimant including at a minimum:
 - 16.1.1. The name of the Claimant;
 - 16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
 - 16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
 - 16.1.4. A brief description of the labor, materials, or equipment furnished;

- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
 - 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
 - 16.1.7. The total amount of previous payments received by the Claimant; and
 - 16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
- 16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
- 16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
18. Modifications to this Bond are as follows: None.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

APPLICATION FOR PAYMENT

Prepared By



Endorsed By



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GUIDELINES FOR THE INTENDED USE OF EJCDC C-620, APPLICATION FOR PAYMENT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

The Application for Payment is used to facilitate periodic progress payments to the Contractor for Work completed and for stored materials and equipment (referred to in this document as "Stored Materials").

For additional information regarding the Application for Payment, see EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), Paragraph 15.01, and EJCDC® C-001, Commentary on the 2018 EJCDC Construction Documents (2018).

2.0 APPLICATION FOR PAYMENT OVERVIEW

This document was prepared in Microsoft Excel due to the number of calculations involved in the preparation of the Application for Payment. The application consists of a Summary worksheet, and 3 supporting worksheets: Lump Sum worksheet, Unit Price worksheet, and Stored Materials worksheet.

- 2.1 *Summary Worksheet* — calculates the amount to be paid to the Contractor at the end of each Application for Payment period. This calculation imports numbers from the supporting worksheets to determine the value of the Work completed and Stored Materials, calculate retainage, and deduct amounts previously paid to determine the amount the Contractor should be paid for the current application period. Application periods are typically one month; however these periods may be extended when Contractor's efforts do not result in the billable completion of Work or storage of materials and equipment during the payment period.

- 2.2 *Lump Sum Worksheet* — calculates the total value for completed Work for which compensation is paid on a Lump Sum basis. The schedule of values included in this worksheet reflects a breakdown of lump sum Work items to which Contractor and Engineer have agreed, pursuant to Article 2 of the General Conditions. Costs for Stored Materials associated with lump sum items are included on this worksheet to calculate the total value for completed lump sum Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for materials currently stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

- 2.3 *Unit Price Worksheet* — calculates the total value for completed Work for which compensation is paid on a Unit Price basis. The schedule of values included in this spreadsheet is typically a tabulation of Unit Price items from the Agreement. Costs for Stored Materials associated with unit price items are included in this worksheet to calculate the total value for completed Unit Price Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for Materials Currently Stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.
- 2.4 *Stored Materials Worksheet* — calculates the total value for materials and equipment that have been purchased and are being stored until they are incorporated into the Work. This worksheet adds materials and equipment to the worksheet as they are brought to the site and stored; such Stored Materials are then deducted from the Stored Materials worksheet total as they are incorporated into the Work, providing a running net value for the materials and equipment remaining in storage. The values of Stored Materials must be manually added to the Lump Sum or Unit Price line items. These do not automatically update when changes are made. The amount of materials remaining in storage is eligible for payment but must be tracked separately from Work completed since different retainage rates may apply to Work completed and Stored Materials.

3.0 Instructions for filling out the Payment Application form

- 3.1 Project-specific information is to be entered in the top portion (header) of the Summary worksheet. This same information will automatically be copied to the other worksheets to complete the headers on all other worksheets.
- 3.2 Outside of the header, data can be entered in non-shaded cells when the sheet is protected. Cells shaded light blue contain equations that will automatically transfer data from other cells or make calculations to complete the worksheet. Altering any of these cells can result in errors in the Application for Payment. It is recommended that the worksheets be protected at all times unless alterations are deliberately being made to the Application for Payment form other than to enter data. See Paragraph 4.0 below for information on Protection of Worksheets.
- 3.3 Enter information regarding each item in the Lump Sum and/or Unit Price worksheets. For Lump Sum projects, each item should represent an item in the schedule of values prepared by the Contractor and approved by the Engineer/Owner, breaking down the Lump Sum amount into measurable components. For Unit Price contracts, use numbers from the Agreement as the schedule of values. Specific information on the data to be entered into each column may be seen by clicking on the header description for that column. Similar comments may be seen for cells in the "Totals" row that indicates how the number is calculated and where this number is exported to another part of the spreadsheet. See the Commentary for additional information.

- 3.4 The equations in the Summary worksheet use numbers imported from both the Lump Sum and Unit Price worksheets. Projects will typically either use the Lump Sum or the Unit Price worksheet, but some projects may use both. If one of the worksheets is not used, it should be hidden and not deleted. If it is deleted, Users will need to correct the equations in the Summary worksheet by unprotecting the worksheet and editing the equations. To hide a worksheet, right click on the worksheet tab at the bottom of the worksheet and select "Hide." To unhide a worksheet, right click on any worksheet tab and select "Unhide," and then select the worksheet to unhide and click "Okay." This same process may be used to hide these Guidelines for Use.
- 3.5 EJCDC C-620 contains calculation functions that are provided solely for the convenience of the user. EJCDC and its Sponsoring Organizations do not warrant or guarantee the accuracy or completeness of any information generated by the calculator.

4.0 Protection of Worksheets

- 4.1 The cells in this Workbook that create the forms or contain equations have been coded to "lock" the cells that should not be altered. It is recommended that the Workbook be Protected (cells locked) at all times unless it is necessary to add or delete rows. Directions for adding and deleting rows are provided in the next section. Passwords can be used to lock the Protect / Unprotect settings on spreadsheets, however the worksheets in this workbook do not require a password.
- 4.2 To unprotect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Unprotect Sheet." To protect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Protect Sheet." This will open a dialog box in which the User is allowed to select protection options. It is recommended that only the top two checkboxes for "Select Locked Cells" and "Select Unlocked Cells" be checked. This will reset the protection for the Worksheet.

5.0 Adding and Deleting Rows

- 5.1 A limited number of blank rows are provided in the Lump Sum, Unit Price, and Stored Material worksheets. Additional rows may be added to these worksheets by the User. The first step in this process is to unprotect the worksheet as previously discussed. After the sheet is unprotected, move with caution to prevent inadvertently deleting any cells that contain equations. To insert a row, right click in the row heading at the left of the spreadsheet and select "Insert." A new row will be inserted at the location where the cursor was placed in the row heading. If more than one new row is desired, left click and drag the cursor to include the desired number of rows, right click in the selected row headings and then select "Insert." It is important that the line immediately above the "Totals" row not be included in the rows selected. Doing so will require that equations in the "Totals" row be adjusted. When rows are inserted, Excel automatically adjusts the equations to include the new rows, unless the row directly above the "Totals" row is also selected.
- 5.2 After new rows are inserted, it is important to copy a line from one of the original rows so correct formatting and equations are copied into each new row. To do this, select the row to be copied by clicking the cell in Column A and dragging the cursor to the last column in the table. Then select "Copy" from the menu or type CTRL+C to copy the cells. Excel will show that this row has been copied by showing a moving dashed line around the cells that are to be copied. Then select the new rows into which the information is to be copied as before and select Paste from the menu or type CTRL+V.
- 5.3 To delete an unused row, right click in the row heading on the left of the spreadsheet for the row to be deleted and select "Delete." The selected row will be deleted. If more than one row is to be deleted, left click and drag the cursor to the desired number of rows to be deleted and then right click to open the menu and select "Delete." Unlike the admonition on adding new rows, it is okay to delete the row just above the "Totals" row.

5.4 After rows have been added or deleted, it is important reset the worksheet protection.

6.0 Saving Files

This file is provided as a Microsoft® Excel Open XML workbook template (.xltx) to prevent this file from being inadvertently changed. When an application for payment is created for a specific project it should be saved as an Excel workbook (.xlsx) file. To do this, select Save As (F12), type in a new file name and select Excel Workbook (.xlsx) from the drop down Save As Type menu.

7.0 License Agreement

This document is subject to the terms and conditions of the License Agreement, 2018 EJCDC® Construction Series Documents. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at www.ejcdc.org and the websites of EJCDC's sponsoring organizations.

Contractor's Application for Payment

Owner: <u>County Commissioners of Worcester</u>	Owner's Project No.: _____
Engineer: <u>Davis, Bowen & Friedel, Inc.</u>	Engineer's Project No.: <u>0085D027</u>
Contractor: _____	Contractor's Project No.: _____
Project: <u>Ocean Pines Biosolids Dewatering Project</u>	
Contract: <u>Ocean Pines Biosolids Dewatering Project</u>	
Application No.: _____ Application Date: _____	
Application Period: From _____ to _____	

1. Original Contract Price	\$	-
2. Net change by Change Orders	\$	-
3. Current Contract Price (Line 1 + Line 2)	\$	-
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	\$	-
5. Retainage		
a. _____ X \$ _____ Work Completed =	\$	-
b. _____ X \$ _____ Stored Materials =	\$	-
c. Total Retainage (Line 5.a + Line 5.b)	\$	-
6. Amount eligible to date (Line 4 - Line 5.c)	\$	-
7. Less previous payments (Line 6 from prior application)		
8. Amount due this application	\$	-
9. Balance to finish, including retainage (Line 3 - Line 4 + Line 5.c)	\$	-

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____	
Signature: _____	Date: _____

Recommended by Engineer	Approved by Owner
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____
Approved by Funding Agency	
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

Contractor's Application for Payment

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Contractor's Application for Payment

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Contractor's Application for Payment

Owner:	County Commissioners of Worcester
Engineer:	Davis, Bowen & Friedel, Inc.
Contractor:	
Project:	Ocean Pines Biosolids Dewatering Project
Contract:	Ocean Pines Biosolids Dewatering Project

Owner's Project No.:	
Engineer's Project No.:	0085D027
Contractor's Project No.:	

[illegible]

Contractor's Application for Payment

Owner:	County Commissioners of Worcester
Engineer:	Davis, Bowen & Friedel, Inc.
Contractor:	
Project:	Ocean Pines Biosolids Dewatering Project
Contract:	Ocean Pines Biosolids Dewatering Project

Owner's Project No.:	
Engineer's Project No.:	0085D027
Contractor's Project No.:	

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L
Bid Item No.	Description	Contract Information				Work Completed		Materials Currently Stored (not in G) (\$)	Work Completed and Materials Stored to Date (H + I) (\$)	% of Value of Item (I / F) (%)	Balance to Finish (F - J) (\$)
		Item Quantity	Units	Unit Price (\$)	Value of Bid Item (C X E) (\$)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) (\$)				
Change Orders											
					-		-		-		-
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Change Order Totals					\$ -		\$ -	\$ -	\$ -		\$ -
Original Contract and Change Orders											
Project Totals					\$ -		\$ -	\$ -	\$ -		\$ -

Stored Materials Summary
Contractor's Application for Payment

Owner:	County Commissioners of Worcester	Owner's Project No.:	
Engineer:	Davis, Bowen & Friedel, Inc.	Engineer's Project No.:	0085D027
Contractor:		Contractor's Project No.:	
Project:	Ocean Pines Biosolids Dewatering Project		
Contract:	Ocean Pines Biosolids Dewatering Project		

Application No.:		Application Period:		From		to		Application Date:				
A	B	C	D	E	F	G	H	I	J	K	L	M
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Materials Stored			Incorporated in Work			Materials Remaining in Storage (I-L) (\$)
						Previous Amount Stored (\$)	Amount Stored this Period (\$)	Amount Stored to Date (G+H) (\$)	Amount Previously Incorporated in the Work (\$)	Amount Incorporated in the Work this Period (\$)	Total Amount Incorporated in the Work (J+K) (\$)	
								-			-	-
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								-			-	-
Totals						\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: County Commissioners of Worcester County Owner's Project No.:
Engineer: Davis, Bowen & Friedel Inc. Engineer's Project No.: 0085D027
Contractor: Contractor's Project No.:
Project: Ocean Pines Biosolids Dewatering Project
Contract Name: Ocean Pines Biosolids Dewatering Project

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

NOTICE OF ACCEPTABILITY OF WORK

Owner: County Commissioners of Worcester County Owner's Project No.:
Engineer: Davis, Bowen & Friedel Inc Engineer's Project No.: 0085D027
Contractor: Contractor's Project No.:
Project: Ocean Pines Biosolids Dewatering Project
Contract Name: Ocean Pines Biosolids Dewatering Project
Notice Date: Effective Date of the Construction Contract:

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated **[date of professional services agreement]** ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*
 - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. A demand for money or services by a third party is not a Claim.
- 11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
 - 12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.
 - 13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
 - 14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
 - 15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
 - 16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
 - 17. *Cost of the Work*—See Paragraph 13.01 for definition.
 - 18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
 - 19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
 - 20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
 - 21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.
32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.
36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
 - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

- 51. Build America, Buy America Act (BABAA) – Requirements instituted by the Bipartisan Infrastructure Law of 2021 mandating domestic preference that all iron and steel, manufactured products, and construction materials are produced in the United States.**
- 52. Construction Materials – Those articles, materials, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives – that are or consist primarily of: non-ferrous metals, plastic and polymer-based products, glass, lumber or drywall.**
- 53. Manufactured Product – Items assembled out of components, or otherwise made or processed from raw materials into finished products. Manufactured products must be manufactured (assembled) in the United States, and the cost of components that were mined, produced, or manufactured in the United States must be greater than 55 percent of the total cost of all components of the project.**
- 54. Manufacturer’s Certification – Documentation provided by a Manufacturer, certifying that the items provided by Manufacturer meet the domestic preference requirements of BABAA.**

1.02 *Terminology*

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:* The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:* The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:* The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
1. does not conform to the Contract Documents;
 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- G. Nothing in the Contract Documents creates:
 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. Abnormal weather conditions;
 - 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
 - 4. Acts of war or terrorism.
- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
 - 1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 - 2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 - 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
 - 1. The circumstances that form the basis for the requested adjustment;
 - 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
 - 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
 - 4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 - 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

- 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
- 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such

owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
 - 2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
 - 3. Technical Data contained in such reports and drawings.
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.
- C. *Reliance by Contractor on Technical Data:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.
- D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their

officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating

whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

- D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;
 - b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 2. complying with applicable state and local utility damage prevention Laws and Regulations;
 3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
 2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
 3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
 4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
3. Technical Data contained in such reports and drawings.

- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition

and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the

required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

- C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.
- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.
- H. Contractor shall require:
 - 1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
 - 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.
- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
 - 1. include at least the specific coverages required;
 - 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
 - 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
 - 4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed

by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);
 4. not seek contribution from insurance maintained by the additional insured; and
 5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will

provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

- E. *Insurance of Other Property; Additional Insurance:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.
 - 1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
 - 2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
 - 1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.
- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.
- D. All products must meet BABAA requirements.**
- E. Contractor shall include Manufacturer's Certification for BABAA requirements with all applicable submittals. If a specific manufacture is used in the bidding, a statement that each applicable Manufacturer will comply with BABAA, must be included with the bid submission. Contractor shall comply with BABAA requirements, including coordination with**

manufacturers, distributors, and suppliers to correct deficiencies in any BABAA requirement and documentation.

F. Engineer/Architect approval of shop drawings or samples shall include review of BABAA documentation.

7.05 *“Or Equals”*

- A. *Contractor’s Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or equal” item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an “or equal” item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.
 - b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor’s Expense:* Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.
- C. *Engineer’s Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal,” which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

- A. *Contractor's Request; Governing Criteria:* Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
 - a. will certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design;
 - 2) be similar in substance to the item specified; and
 - 3) be suited to the same use as the item specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from the item specified; and

- 2) available engineering, sales, maintenance, repair, and replacement services.
- d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others.

If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all

fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by

Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 Submittals

A. Shop Drawing and Sample Requirements

1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
 - 2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.
3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. Submittal Procedures for Shop Drawings and Samples: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. Shop Drawings

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. Samples

- a. Contractor shall submit the number of Samples required in the Specifications.
- b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may

require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Engineer's Review of Shop Drawings and Samples

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.
3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.
5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent

resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
 - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.
 - d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.

- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
 - 1. Observations by Engineer;
 - 2. Recommendation by Engineer or payment by Owner of any progress or final payment;
 - 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 - 4. Use or occupancy of the Work or any part thereof by Owner;
 - 5. Any review and approval of a Shop Drawing or Sample submittal;
 - 6. The issuance of a notice of acceptability by Engineer;
 - 7. The end of the correction period established in Paragraph 15.08;
 - 8. Any inspection, test, or approval by others; or
 - 9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.
- F. **Contractor shall certify upon completion that all work and materials have complied with BABAA requirements.**
- G. **For any change orders, Contractor shall provide BABAA compliant documentation for any new products or materials required by the change.**
- H. **Installation of materials or products that are not compliant with BABAA requirements shall be considered defective work. An approved Manufacturer's Certification or waiver prior to items being delivered to the project site is required.**
- I. **By submitting an application for payment, based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials, to contractor's knowledge, are compliant with BABAA requirements.**

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses,

damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.
- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay,

disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. An itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
 - 1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
 - 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable

direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On

the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.
- E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise

or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.
- B. If Owner has issued a Work Change Directive and:
1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 - 1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
 - 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 - 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit will be determined as follows:
 - 1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
 - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the

proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
 4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *Resolution of Certain Change Proposals***: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion***: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

- A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 - 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and

decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which

include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.
 - c. *Construction Equipment Rental*
 - 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

- 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.
- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.
 - g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:
1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
 2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
6. Expenses incurred in preparing and advancing Claims.
7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor's Fee

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

- E. Documentation and Audit:** Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

- A.** It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

- B. *Cash Allowances*: Contractor agrees that:
1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.
- E. *Adjustments in Unit Price*
1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
 2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other

Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 3. by manufacturers of equipment furnished under the Contract Documents;
 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against

payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees,

Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
 - 2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 - 3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 - 4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work;
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. The Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. The Contract Price has been reduced by Change Orders;

- i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
 - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
 - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor.

- If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
 - E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
 - F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
 - 2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
 2. The final Application for Payment must be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all duly pending Change Proposals and Claims; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
 3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
- B. *Engineer's Review of Final Application and Recommendation of Payment:* If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10

days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

- C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such adjacent areas;
 - 2. correct such defective Work;
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this article, Owner or Contractor may:
1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
 2. agree with the other party to submit the dispute to another dispute resolution process; or
 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, "Paragraph SC-4.05."

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

~~No suggested Supplementary Conditions in this Article.~~

SC-1.01.A.8 – Add the following at the end of the Paragraph:

The Change Order form to be used on this Project is EJCDC C-941 (2018). Agency approval is required before Change Orders are effective.

SC-1.01.A.30 – Add the following at the end of the Paragraph:

For the purposes of Rural Development, this term is synonymous with the term "applicant" as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the federal programs.

SC-1.01.A.50 – Add the following at the end of the Paragraph:

The Work Change Directive form to be used on this Project is EJCDC C-940 (2018). Agency approval is required before a Work Change Directive is issued.

SC-1.01.A.51 – Add the following new paragraph immediately after Paragraph 1.01.A.50:

51. Agency - The Project is financed in whole or in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.). The Rural Utilities Service programs are administered through the USDA Rural Development offices; therefore, the Agency for these documents is USDA Rural Development.

SC-1.01.A.52 – Add the following new paragraph with the title "Domestic Preference Definitions" immediately after Paragraph 1.01.A.51:

52. a Build America, Buy America Act (BABAA) - Requirements mandated by Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953-58 mandating domestic preference that all iron and steel, manufactured products, and construction materials are produced in the United States.

- 52.b Construction Materials** - Those articles, materials, or supplies — other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives— that are or consist primarily of: non- ferrous metals, plastic and polymer- based products, glass, lumber or drywall.
- 52.c Contractor’s Certification** - Documentation submitted by the Contractor upon Substantial Completion of the Contract that all iron and steel, manufactured products, and construction materials are produced in the United States.
- 52.d De Minimis** - Materials and products that represent a small portion of an infrastructure project, specifically no more than 5% of the project costs up to a maximum of \$1,000,000.
- 52.e Domestic Preference** - The Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953.
- 52.f Engineer’s Certification** - Documentation submitted by the Engineer that Drawings, Specifications, and Bidding Documents comply with Domestic Preference requirements.
- 52.g Manufactured Product** – Items assembled out of components, or otherwise made or processed from raw materials into finished products. Manufactured products must be manufactured (assembled) in the United States, and the cost of components that were mined, produced, or manufactured in the United States must be greater than 55 percent of the total cost of all components of the product.
- 52.h Manufacturer’s Certification** - Documentation provided by the Manufacturer stating that Domestic Preference requirements have been satisfied for all provided items. If items are purchased via a Supplier, distributor, vendor, etc. from the Manufacturer directly, then the Supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certifications to the parties purchasing the products.
- 52.i Minor Components** - Components within an iron and/or steel product otherwise compliant with the Domestic Preference requirements. This waiver, typically used by Manufacturers, allows use of non-domestically produced miscellaneous Minor Components comprising up to five percent of the total material cost of an otherwise domestically produced iron and steel product. However, unless a separate waiver for a product has been approved, all other iron and steel components in said product must still meet the Domestic Preference requirements. This waiver does not exempt the whole product from the Domestic Preference requirements only Minor Components within said product and the iron or steel components of the product must be produced domestically.
- 52.j Primarily Iron or Steel** - A product is made of greater than 50 percent iron or Steel on a materials cost basis.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01 Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

- A. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- B. *Evidence of Owner's Insurance:* After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

2.02 *Copies of Documents*

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor ~~three~~ **five** printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and **one** in electronic portable document format (PDF).

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

- A. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.
 - 1. *Basic Requirements*
 - a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.
 - b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.
 - c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.

- d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.
- e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.
- f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or
3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

- a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.
 - 1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is **10 MB**. Attachments larger than that may be exchanged using large file transfer functions or physical media.
 - 2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.
- b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

- c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.
- d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.
- e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.
- f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.
- g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
- h. The Owner will operate a Project information management system (also referred to in this EDP as "Project Website") for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information. The following conditions and standards will govern use of the Project Website:

- 1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;
- 2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;
- 3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and
- 4) Include any other Project Website attributes that may be pertinent to Contractor's use of the facility and pricing of such use.

B. *Software Requirements for Electronic Document Exchange; Limitations*

1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.
 - a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.
2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.
3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

C. *Requests by Contractor for Electronic Documents in Other Formats*

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.
2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:

- a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.
 - b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.
 - c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.
 - d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.
3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at **\$150** per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No suggested Supplementary Conditions in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01.A – Delete the last sentence of paragraph.

4.05 *Delays in Contractor's Progress*

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

- a. If “abnormal weather conditions” as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled. **Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information listed in SC 4.05.C.5.b.**
- b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:
 - 1) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by the nearest weather monitoring station.

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

No suggested Supplementary Conditions in this Article.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).
2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

SC-6.01 Delete the last sentence and add the following paragraphs immediately after Paragraph 6.01.B:

1. All Property and Liability Insurance to be purchased by CONTRACTOR shall be placed with insurance companies, which carry a rating of A- or better from A.M. Best and Company Insurance Rating Service. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be **2** years after Substantial Completion.

6.02 Insurance—General Provisions

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 Contractor's Insurance

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- D. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Bodily injury by accident—each accident	\$ 500,000
Bodily injury by disease—aggregate	\$ 1,000,000
Employer's Liability	
Each accident	\$ 100,000
Each employee	\$ 100,000
Policy limit	\$ 500,000

- E. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- F. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
 - a. Such insurance must be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.
 6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
 7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- G. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
 2. Any exclusion for water intrusion or water damage.
 3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
 4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

H. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	\$ 2,000,000
Property Damage	\$ 500,000
Bodily Injury and Property Damage—Each Occurrence	\$ 1,000,000

- I. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	\$ 1,000,000
Each Accident	\$ 1,000,000
Property Damage	
Each Accident	\$ 500,000
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	\$ 1,000,000

- J. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	\$ 1,000,000
General Aggregate	\$ 1,000,000

- K. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy

was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of **\$1,000,000** after accounting for partial attribution of its limits to underlying policies, as allowed above.

- L. *CONTRACTUAL ENDORSEMENT* - The contractual liability required of the Standard General Conditions shall provide coverage for not less than the following amounts:

Contractual Liability	Policy limits of not less than:
Bodily Injury	
Each Accident	\$ 500,000
Property Damage	
Each Accident	\$ 500,000
Annual Aggregate	\$ 500,000

CONTRACTOR shall provide Excess Umbrella Liability Coverage as specified in SC 6.03.I

- M. *OWNER'S LIABILITY INSURANCE* - Add the following language to the end of paragraph 6.02G of the Standard General Conditions:

Such coverage, if elected by the OWNER, shall be in addition to the OWNER'S coverage provided under the CONTRACTOR'S Liability Insurance policy.

- N. *PROPERTY INSURANCE* - Delete Paragraph 6.04B of the Standard General Conditions in its entirety and insert the following in its place:

CONTRACTOR shall purchase and maintain until final payment property insurance upon the Work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by laws and regulations). This insurance shall include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, and ENGINEER'S Consultants in the Work (all of whom shall be listed as insured or additional insured parties), shall insure against the perils of fire and extended coverage, shall include "all-risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and such other perils as may be provided in these Supplementary Conditions, and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all-risk" insurance or otherwise provided in these Supplementary Conditions, CONTRACTOR shall purchase and maintain similar property insurance on portions of the Work stored on and off the site or in transit when such portions of the Work are to be included in an Application for Payment. The policies of insurance required to be purchased and maintained by CONTRACTOR in accordance with this paragraph 6.04B shall comply with the requirements of paragraph 5.06.C of the Standard General Conditions.

- O. *BOILER, MACHINERY AND OTHER PROPERTY INSURANCE* - Amend the first sentence of Paragraph 5.06.B by deleting the first word "OWNER" and inserting in its place: CONTRACTOR and as so amended Paragraph 5.06.B remains in effect.

- P. *SPECIAL INSURANCE* - Delete paragraph 5.06.E in its entirety and insert the following in its place:

CONTRACTOR shall, at its discretion, purchase any special property insurance, as necessary and such additional coverage may be a part of the required property insurance policy.

- Q. *RECEIPT AND APPLICATION OF PROCEEDS* - Delete all references to OWNER and substitute with: OWNER and CONTRACTOR. and as so amended paragraph 5.08 remains in effect.

- R. *ACCEPTANCE OF INSURANCE* - Delete paragraph 5.09.A of the Standard General Conditions in its entirety and insert the following in its place:

If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with paragraphs 5.04, 5.06, and 5.07 on the basis of its not complying with the Contract Documents, OWNER shall notify CONTRACTOR in writing thereof within ten days of the date of delivery of such certificates in accordance with paragraph 2.05.C. CONTRACTOR shall provide to the OWNER such additional information in respect to insurance provided as the OWNER may reasonably request. Failure by OWNER to give any such notice of objection within the time provided shall constitute acceptance of such insurance purchased by the CONTRACTOR as complying with the Contract Documents.

At the request of OWNER, CONTRACTOR shall provide a copy of the insurance policy under which the coverage for the contract is provided. OWNER shall review insurance coverage or will assign, at its discretion, a qualified party to review all insurance coverage's to be provided. Upon completion of review and in accordance with Paragraph 5.07 in the Standard General Conditions, CONTRACTOR and CONTRACTOR'S property insurer or insurers may be required to sign an Insured Claim Waiver, or CONTRACTOR, if required, shall secure similar signatures on such forms from all subcontractors and their property insurers.

ENGINEER shall have no responsibilities regarding the advising, requiring, or obtaining of any form of insurance.

- SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

- F. *Builder's Risk Requirements*: The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

- a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
 - b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.
2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
 4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 5. extend to cover damage or loss to insured property while in transit.
 6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
 7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
 8. include performance/hot testing and start-up, if applicable.
 9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
 10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds."

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision:

- G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

ARTICLE 7—CONTRACTOR’S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be Mondays through Friday from 0800 hours to 1600. Contractor shall request in writing and obtain written approval to work on Weekends and Holidays
2. Owner's legal holidays are: New Year’s Day (January 1st); Martin Luther King Jr. Day (third Monday in January); President’s Day (third Monday in February); Memorial Day (last Monday in May); Juneteenth National Freedom Day (June 19th); Independence Day (July 4th); Labor Day (first Monday in September); Columbus Day (second Monday in September); General Election Day (biennially on Tuesday following the first Monday in November); Veteran’s Day (November 11th); Thanksgiving Day (fourth Thursday in November); Day after Thanksgiving; Christmas Eve (December 24th); and Christmas Day (December 25th).SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

- D. **Contractor** shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer’s services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.03 Add the following new subparagraph immediately after Paragraph SC-7.03.D:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as **the Resident Project Representative’s hourly rate over 40 hours in a given week.**

SC-7.04.D – Add the following new paragraph immediately after Paragraph 7.04.C:

C. All products must meet Domestic Preference requirements.

SC-7.04.E – Add the following new paragraph immediately after Paragraph 7.04.D:

D. For projects utilizing a *De Minimis* waiver, Contractor shall maintain an itemized list of non-domestically produced components and ensure that the cost is less than 5% of total project cost for project up to a maximum of \$1,000,000.

SC-7.05.A – Amend the third sentence of paragraph by striking out the following words:

Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item is permitted,

SC-7.05.A.1.a.3 – Amend the last sentence of Paragraph a.3 by striking out “and;” and adding a period at the end of Paragraph a.3.

SC-7.05.A.1.a.4 – Delete paragraph in its entirety and insert “Deleted.”

SC-7.05.B – Add the following at the end of paragraph:

Contractor shall include a Manufacturer’s Certification or waiver for compliance with Domestic Preference requirements and supporting data, as applicable. Refer to Sample Language for Manufacturer’s Certification provided in these Contract Documents.

SC-7.06.A.3.a.2 – Remove “and” from the end of paragraph.

SC-7.06.A.3.a.3 – Add “; and” to the end of paragraph.

SC-7.06.A.3.a.4 – Add the following new paragraph immediately after Paragraph 7.06.A.3.a.3:

4. Comply with Domestic Preference requirements by providing Manufacturer’s Certification or waiver , as applicable. Refer to Sample Language for Manufacturers’ Certification provided in these Contract Documents.

SC-7.07.A – Amend by adding the following to the end of the paragraph:

The total amount of work subcontracted by the Contractor shall not exceed fifty percent of the Contract price without prior approval from the Owner, Engineer and Agency.

SC-7.07.B – Delete paragraph in its entirety and insert ”Deleted”.

SC-7.07.E – Delete the second sentence of paragraph and insert the following in its place:

Owner may not require that Contractor use a specific replacement.

7.10 *Taxes*

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

- A. Owner is exempt from payment of sales and compensating use taxes of the State of **Maryland** and of cities and counties thereof on all materials to be incorporated into the Work.
 - 1. The County will provide a tax exemption certificate number. It is the responsibility of the Contractor to determine what costs are tax exempt.

SC-7.12.A Amend paragraph by adding the following after “written interpretations and clarifications,”:

Manufacturers’ Certifications,

SC-7.16.A.1.c – Amend paragraph by deleting the last period and adding:

, including Manufacturer’s Certification, or waiver for any item in the submittal subject to Domestic Preference requirements. Refer to the Sample Language for Manufacturers’ Certification provided in these Contract Documents.

SC-7.16.C.9 – Add new paragraph immediately after Paragraph 7.16.C.8:

9. Engineer's review and approval of a Shop Drawing or Sample shall include review of Manufacturers' Certifications and any waivers in order to document compliance with Domestic Preference requirements, as applicable.

SC-7.17.F – Add new paragraph immediately after Paragraph 7.17.E:

E. Contractor shall certify upon Substantial Completion that all Work and Materials have complied with Domestic Preference requirements. Contractor shall provide Certification to Owner and Engineer. Refer to the Sample Language for Contractor's Certification provided in these Contract Documents.

ARTICLE 10 - ENGINEER'S STATUS DURING CONSTRUCTION

10.03 Resident Project Representative

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
 - 1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
 - 2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
 - 3. *Liaison*
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
 - 4. *Review of Work; Defective Work*
 - a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*
 - a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
 6. *Payment Requests*: Review Applications for Payment with Contractor.
 7. *Completion*
 - a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
 5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
 6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
 7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11 - CHANGES TO THE CONTRACT

~~Deleted No suggested Supplementary Conditions in this Article.~~

SC-11.02.C – Add new paragraph immediately after Paragraph 11.02.B:

A. The Engineer or Owner shall contact the Agency for concurrence on each Change Order prior to issuance. All Contract Change Orders must be concurred on (signed) by Agency before they are effective.

SC-11.03.A.2 - Add new Paragraph 11.03.A.2 immediately after Paragraph 11.03.A, which shall be renamed Paragraph 11.03.A.1:

2. The Engineer or Owner shall contact the Agency for concurrence on each Work Change Directive prior to issuance. Once authorized by Owner, a copy of each Work Change Directive shall be provided by Engineer to the Agency.

SC-11.05.B – Add the following at the end of this paragraph:

For Owner-authorized changes in the Work, the Contractor will provide the Manufacturer's Certification, or waiver, for materials subject to Domestic Preference requirements except when sole-source is specified, in which case the Engineer will provide the Manufacturer's Certification, or waiver.

SC-11.09.B.2.c – Add new paragraph immediately after Paragraph 11.09.B.2.b:

c. For change orders involving materials subject to Domestic Preference requirements, Contractor shall include a Manufacturer's Certification or waiver, as applicable. Refer to the Sample Language for Manufacturer's Certification provided in these Contract Documents.

ARTICLE 12 - CLAIMS

No suggested Supplementary Conditions in this Article.

ARTICLE 13 - COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 Cost of the Work

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

- a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than \$500.

SC-13.02.C – Delete paragraph in its entirety and insert "Deleted".

SC 13.03.E – Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. Adjustments in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the extended price of a particular item of Unit Price Work amounts to **25** percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than **25** percent from the estimated quantity of such item indicated in the Agreement; and

- b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

~~Deleted No suggested Supplementary Conditions in this Article.~~

SC-14.03.G – Add new paragraph immediately after Paragraph 14.03.F:

G. Installation of materials that are non-compliant with Domestic Preference requirements shall be considered defective work. Contractor should ensure that Engineer has an approved Manufacturer's Certification, or waiver, prior to any domestic preference compliant item being delivered to the project site.

ARTICLE 15 - PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

~~Deleted No suggested Supplementary Conditions in this Article.~~

SC-15.01.B.4 – Add the following language at the end of paragraph:

No

payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage or invest the retainage for the benefit of the Contractor.

SC-15.01.B.5 – Add new paragraph immediately after Paragraph 15.01.B.4:

5. The Application for Payment form to be used on this Project is EJCDC® C-620. The Agency must approve all Applications for Payment before payment is made.

SC-15.01.B.6 – Add new paragraph immediately after Paragraph 15.01.B.5:

6. By submitting an Application for Payment, based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials are compliant with Domestic Preference requirements. Manufacturer's Certification for material(s) satisfy these requirements. Refer to the Sample Language for Manufacturer's Certification provided in these Contract Documents.

SC-15.01.C.2.d – Add the following new paragraph immediately after Paragraph 15.01.C.2.c:

d. The materials presented for payment in an Application for Payment comply with Domestic Preference requirements.

SC-15.01.D.1 – Delete paragraph in its entirety and insert the following in its place:

The Application for Payment with Engineer’s recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC-15.02.A – Amend paragraph by striking out the following text: “7 days after”.

SC-15.03.A – Modify by adding the following after the last sentence:

Contractor shall also submit the Contractor’s Certification of Compliance certifying that to the best of the Contractor’s knowledge and belief all Iron and Steel products, Manufactured Products, and Construction Materials proposed in the Shop Drawings, Change Orders, and Partial Payment Estimates, and those installed for the Project, comply with Domestic Preference requirements.

ARTICLE 16 - SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 17 - FINAL RESOLUTIONS OF DISPUTES

17.02 Arbitration

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

17.02 Arbitration

- A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of \$100,000 or less will be settled in accordance with the American Arbitration Association’s supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

- C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.
- D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.
- E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.
- F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.
- G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
 - 1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;
 - 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;
 - 3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and
 - 4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.
- H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.
- I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02.

17.03 *Attorneys' Fees*

- A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

ARTICLE 18 – MISCELLANEOUS

SC-18.11 – Add new paragraph immediately after Paragraph 18.10:

18.10 *Tribal Sovereignty*

- A. **No provision of this Agreement will be construed by any of the signatories as abridging or debilitating any sovereign powers of the [insert name of Tribe] Tribe; affecting the trust- beneficiary relationship between the Secretary of the Interior, Tribe, and Indian landowner(s); or interfering with the government-to-government relationship between the United States and the Tribe.**

SC-19 – Add the following new Article 19 immediately after Article 18

ARTICLE 19 - FEDERAL REQUIREMENTS

19.01 Agency Not a Party

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees, is a party to this Contract.

19.02 Contract Approval

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the "Certificate of Owner's Attorney" (Exhibit G of this Bulletin) before Owner submits the executed Contract Documents to Agency for approval.
- B. Agency concurrence is required on both the Bid and the Contract before the Contract is effective.

19.03 Conflict of Interest

- A. Contractor may not knowingly contract with a Supplier or Manufacturer if the individual or entity who prepared the Drawings and Specifications has a corporate or financial affiliation with the Supplier or Manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest or other interest in or a tangible personal benefit from the Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

19.04 Gratuities

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.
- B. In the event this Contract is terminated as provided in paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

19.05 Small, Minority and Women's Businesses

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor will take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps will include:
 - 1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
 - 2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
 - 3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
 - 4. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises; Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

19.06 Anti-Kickback

- A. Contractor shall comply with the Copeland Anti-Kickback Act (40 USC 3145) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

19.07 Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended

- A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

19.08 Equal Employment Opportunity

- A. The Contract is considered a federally assisted construction contract. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of “federally assisted construction contract” in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, “Equal Employment Opportunity” (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 CFR part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”

19.09 Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)

- A. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification (RD Instruction 1940-Q Exhibit A-1). The Contractor certifies to the Owner and every subcontractor certifies to the Contractor that it will not and has not used federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

19.10 Environmental Requirements

- A. When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions:
 - 1. Wetlands – When disposing of excess, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
 - 2. Floodplains – When disposing of excess, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.
 - 3. Historic Preservation - Applicants shall ensure that Contractors maintain a copy of the following inadvertent discovery plan onsite for review:
 - a. If during the course of any ground disturbance related to any Project, any post review discovery, including but not limited to, any artifacts, foundations, or other indications of past human occupation of the area are uncovered, shall be protected by complying with 36 CFR § 800.13(b)(3) and (c) and shall include the following:

- i. All Work, including vehicular traffic, shall immediately stop within a 50 ft. radius around the area of discovery. The Contractor shall ensure barriers are established to protect the area of discovery and notify the Engineer to contact the appropriate RD personnel. The Engineer shall engage a Secretary of the Interior (SOI) qualified professional archeologist to quickly assess the nature and scope of the discovery; implement interim measures to protect the discovery from looting and vandalism; and establish broader barriers if further historic and/or precontact properties, can reasonably be expected to occur.
- ii. The RD personnel shall notify the appropriate RD environmental staff member, the Federal Preservation Officer (FPO), and State Historic Preservation Office (SHPO) immediately. Indian tribe(s) or Native Hawaiian Organization (NHOs) that have an interest in the area of discovery shall be contacted immediately. The SHPO may require additional tribes or NHOs who may have an interest in the area of discovery also be contacted. The notification shall include an assessment of the discovery provided by the SOI qualified professional archeologist.
- iii. When the discovery contains burial sites or human remains, the Contractor shall immediately notify the appropriate RD personnel who will contact the RD environmental staff member, FPO, and the SHPO. The relevant law enforcement authorities shall be immediately contacted by onsite personnel to reduce delay times, in accordance with tribal, state, or local laws including 36 CFR Part 800.13; 43 CFR Part 10, Subpart B; and the Advisory Council on Historic Preservation's Policy Statement Regarding treatment of Burial Sites, Human Remains, or Funerary Objects (February 23, 2007).
- iv. When the discovery contains burial sites or human remains, all construction activities, including vehicular traffic shall stop within a 100 ft. radius of the discovery and barriers shall be established. The evaluation of human remains shall be conducted at the site of discovery by a SOI qualified professional. Remains that have been removed from their primary context and where that context may be in question may be retained in a secure location, pending further decisions on treatment and disposition. RD may expand this radius based on the SOI professional's assessment of the discovery and establish broader barriers if further subsurface burial sites, or human remains can reasonably be expected to occur. RD, in consultation with the SHPO and interested tribes or NHOs, shall develop a plan for the treatment of native human remains.
- v. Work may continue in other areas of the undertaking where no historic properties, burial sites, or human remains are present. If the inadvertent discovery appears to be a consequence of illegal activity such as looting, the onsite personnel shall contact the appropriate legal authorities immediately if the landowner has not already done so.
- vi. Work may not resume in the area of the discovery until a notice to proceed has been issued by RD. RD shall not issue the notice to proceed until it has determined that the appropriate local protocols and consulting parties have been consulted.
- vii. Inadvertent discoveries on federal and tribal land shall follow the processes required by the federal or tribal entity.

4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.
5. Mitigation Measures – The following environmental mitigation measures are required on this Project: *None*

19.11 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708)

- A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor will comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor will compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic will be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

19.12 Debarment and Suspension (Executive Orders 12549 and 12689)

- A. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

19.13 Procurement of recovered materials

- A. The Contractor will comply with 2 CFR Part 200.322, “Procurement of recovered materials.”

19.14 Domestic Preference

- A. Build America, Buy America Act (BABAA). All Iron and Steel Products, Manufactured Products, and Construction Materials used in this project must comply with the Build America, Buy America Act (BABAA) requirements mandated by Title IX of the Infrastructure Investment and Jobs Act (IIJA), Pub. L. 117-58, §§ 70901-70953. Aggregates such as stone, sand, or gravel do not apply to BABAA.
- B. The following waivers apply to this Contract:
 1. BABAA De Minimis, Small Grants and Minor Components

EXHIBIT B—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI’s and responses to RFI’s, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contractors Submittals (Shop Drawings, “or equal” requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner’s and Engineer’s responses to Contractor’s Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	
Notes				
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.			
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.			
Key				
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies			
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)			
PDF	Portable Document Format readable by Adobe® Acrobat Reader Version 2022.001.20169 or later			
DWG	Autodesk® AutoCAD .dwg format Version - NA			
DOC	Microsoft® Word .docx format Version 2202 (Microsoft 365)			
EXC	Microsoft® Excel .xls or .xml format Version 2202 (Microsoft 365)			
DB	Microsoft® Access .mdb format Version 2202 (Microsoft 365)			

WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner:

Owner's Project No.:

Engineer:

Engineer's Project No.:

Contractor:

Contractor's Project No.:

Project:

Contract Name:

Date Issued:

Effective Date of Work Change Directive:

Contractor is directed to proceed promptly with the following change(s):

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: \$ _____ **[increase] [decrease] [not yet estimated].**

Contract Time: _____ days **[increase] [decrease] [not yet estimated].**

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

Recommended by Engineer

Authorized by Owner

By:

Title:

Date:

CHANGE ORDER NO.: [Number of Change Order]

Owner:

Engineer:

Contractor:

Project:

Contract Name:

Date Issued:

Owner's Project No.:

Engineer's Project No.:

Contractor's Project No.:

Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	Change in Contract Times [State Contract Times as either a specific date or a number of days]
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. [Number of previous Change Order] : \$ _____	[Increase] [Decrease] from previously approved Change Orders No.1 to No. [Number of previous Change Order] : Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: \$ _____	[Increase] [Decrease] this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)

Authorized by Owner

By: _____

Title: _____

Date: _____

Authorized by Owner

Approved by Funding Agency (if applicable)

By: _____

Title: _____

Date: _____

FIELD ORDER NO.: [Number of Field Order]

Owner:

Owner's Project No.:

Engineer:

Engineer's Project No.:

Contractor:

Contractor's Project No.:

Project:

Contract Name:

Date Issued:

Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

SECTION C

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The site address is Ocean Pines Wastewater Treatment Plant Operations Building located at 1000 Shore Lane, Ocean Pines, Maryland 21811. Contract includes all work designated in the Contract Documents including the Specifications and as shown on the Plans and generally consists of the installation of a new biosolids dewatering building, sludge holding tank, dewatering belt press, and other miscellaneous related work as indicated within the contract documents. Work includes furnishing all equipment, material, and labor for the work described in the contract document drawings and specifications. In case of conflict between contract plans and specifications, the Contractor shall request a determination from the ENGINEER as to which shall govern. The Contractor shall furnish all implements, machinery, tools, equipment, material and labor necessary to the performance of the work and shall furnish and do everything necessary to make the work perfect, complete, neat and finished, and the Contractor shall maintain all the work to be done under this Contract in this condition at the time the work is finally inspected.
- B. The work shall be done in full conformance with all codes, rules and regulations of the Worcester County, Maryland and the State of Maryland pertaining to this PROJECT.

1.2 GENERAL CONSTRUCTION REQUIREMENTS

- A. Contractor shall meet with and fully cooperate and coordinate their activities with the Worcester County Department of Public Work and other utility providers and obtain permits from all regulatory agencies, including dewatering permits, unless provided in these documents and addenda.
- B. Set up traffic controls prior to work in right-of-way as required.
- C. Contractor is solely responsible for detailed sequence of construction subject to OWNER'S approval.
- D. Contractor shall plan the work to avoid conflicts with existing utilities and shall at Contractor's sole expense adjust temporary and permanent water, drains, sewer and storm drains if and as needed to eliminate conflicts.
- E. Install erosion and sediment control requirements and complete soils investigation.
- F. Perform all test pitting well in advance of work to verify utility crossing depths.
- G. All federal, state and local regulations will be followed for safety, including, but not limited to, dust control and noise level restrictions.
- H. Working hours areas shall be limited to 7:30 a.m. to 4:30 p.m., Monday through Friday, unless extended by the OWNER.

- I. The PROJECT design was completed with the best available information. The location of existing utilities including but not limited to water pipes, valves, drains, sewer and other utilities which are not all known at this time and shall be determined by the Contractor.
- J. Contractor shall make every effort to assure shop drawings and submittals are complete at first submission.
- K. Storage of materials including piping shall be on crates, wood cribs, or pallets to elevate them above the ground. Do not store pipe or other materials in direct contact with dirt or mud. Keep interior of all pipe materials free of debris and storm water during storage.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 – GENERAL

1.1 GENERAL

- A. Payment for materials furnished and work done under this contract will be made as herein below stipulated, for the actual amount of materials supplied and work done under authorization of the ENGINEER and in accordance with the prices bid in the Bid Form. The Contractor shall not be entitled to receive additional compensation for anything furnished or done, except for such extra work as shall be authorized by written order.
- B. It is intended that all work shown on the contract drawings and included in the specifications is to be paid for under the items listed in the bid form. The absence of a bid item for any specific category of work shall be interpreted as meaning that the cost of such work, accomplished as defined by the contract documents, shall be included in the prices bid for the related item listed in the Bid Form.
- C. The OWNER may elect to increase or decrease quantities above the indicated estimated quantity or delete entire bid items in their entirety without change in unit prices or impact on remaining work items.
- D. Bid prices for base bid items shall include furnishing all materials, equipment and labor for the scope of work of this contract and all appurtenant work to complete the work as shown or described. All hauling and disposing of excess, unsuitable excavated material or non-reusable removed materials shall be included in the prices bid. Bid prices shall include excavation, backfill of trenches or subgrade and sub-base preparation with suitable materials removed from the excavation or excess suitable materials from the PROJECT site, or from imported source; furnishing, placing, compaction, and compaction testing; dewatering, sheeting, shoring and bracing, gravel bedding; locating existing utilities or storm drains; unclassified excavation; removal, storage, re-hauling and replacement of all material encountered during excavation; disposal of unsuitable or excess material; wetting or drying borrow for proper placement and compaction; maintenance or protection of excavation or subgrade; furnishing and placing pipe, structures, and appurtenances; support and protection of adjacent property, utilities and structures encountered and restoration in-kind in case of damage; demolition, removal of salvaged equipment to OWNER'S required site; connection of water lines to water main and disinfection; maintaining stormwater pipe and catch basins and removing all debris after final restoration; traffic and pedestrian control ,restoration, sediment erosion control; lay out, stake out, as built surveys; and coordination, control of grades for positive drainage, and all other appurtenant work as shown or specified.
- E. For Lump Sum bid items, no measurement will be made. Payment will be made on a lump sum basis at the lump sum price bid for work completed and approved by the ENGINEER.

PART 2 – BID ITEMS

2.1 BID ITEMS FOR MOBILIZATION, BONDS, INSURANCE, AND DEMOBILIZATION (Bid Item No. 1)

- A. Mobilization shall consist of, but not be limited to, storage, staging, utility locates, meetings, sanitary and other facilities as required by the specifications, by local or state law, or by regulation, providing access to the PROJECT site, obtaining necessary permits and licenses and payment of fees, and providing required insurance and bonds. Demobilization shall consist of removal of all equipment, storage items, and restoration.
- B. Payment for mobilization will be made at the lump sum price bid. The lump sum price bid for mobilization shall be limited to a maximum of three (3%) percent of the total base bid. Furthermore, the maximum amount of the lump sum price bid for mobilization that is requisitioned on the Construction Requisition No. 1 shall not exceed fifty (50) percent of the lump sum price bid and each succeeding requisition shall be limited to a maximum of ten (10) percent of the lump price bid until the entire lump sum price less retainage has been requisitioned.

2.2 BID ITEMS FOR FURNISHING AND INSTALLING OCEAN PINES BIOSOLIDS DEWATER PROJECT COMPLETE (Bid Item No. 2)

- A. The price bid shall include and cover all costs of furnishing, delivering and installing all items as required for the complete construction of the Ocean Pines Biosolids Dewatering Project as provided in the contract documents. This bid item includes but is not limited to all items as shown in the contract documents and deemed reasonable and necessary for completion of the project.
- B. All accessory and incidental work as shown or required within the contract documents.
- C. Payment for all work associated with this item will be made at the lump sum price bid. Partial payment shall be made based on a schedule of values prepared by the contractor and approved by the Engineer. Partial payment shall be proportioned in accordance with work completed.

CONTINGENCIES:

2.3 BID ITEM FOR FURNISHING AND PLACING SELECT FILL FROM OFF-SITE SOURCE (Bid Item No. 3)

- A. The unit price bid for furnishing and placing off-site select backfill shall include and cover the excavation and disposal of unsuitable material and furnishing, placing and compacting of off-site select backfill and all other incidental work. This bid item is to be used only if and as directed by Engineer.
- B. Measurement for quantities of select backfill will be based upon the authorized depth of placement in trench and the trench payment width indicated and for the authorized depth, width, length for subgrade replacement or for placement around structures.
- C. Payment for all work in connection with select backfill will be made at the appropriate unit price for the volume actually furnished, placed and compacted within the limits

defined and as authorized. This item is only to be used should insufficient on-site select material not be available for use.

2.4 BID ITEM FOR FURNISHING AND PLACING NO. 57 GRAVEL (Bid Item No. 4)

- A. The price bid for excavation below subgrade and gravel refill shall include and cover the furnishing of all equipment, labor, materials, excavation, hauling, additional placing and removal of sheeting, disposing of unsuitable material, furnishing, placing and compacting No.57 gravel and all incidentals necessary to complete this item of work. This bid item is to be used only if and as directed by Engineer.
- B. Measurement for quantities of excavation below subgrade and gravel refill will be based upon the authorized depth and length and the trench payment width shown on the drawings.
- C. Payment for all work in connection with excavation below subgrade and gravel refill will be made at the appropriate unit price bid for the volume of gravel actually placed as authorized.

2.5 BID ITEM FOR TEST PITTING (Bid Item No. 5)

- A. The prices bid for miscellaneous excavation and backfill for test pitting shall include and cover excavation and backfill, placement and removal of sheeting, dewatering, removal and restoration (temporary & permanent) of pavement and all other incidental items of work. This item shall be provided only if and as directed by the Engineer and does not include test pitting already noted and shown on the drawings.
- B. Measurement for quantities of miscellaneous excavation and backfill will be based upon the authorized depth, width and length of the excavation and backfill.
- C. Payment for all work in connection with miscellaneous excavation and backfill will be made at the unit prices bid per cubic yard for the volume actually excavated and refilled within the limits defined and authorized by the Engineer.

2.6 BID ITEM FOR FURNISHING AND PLACING 4,000 PSI CONCRETE (Bid Item No. 6)

- A. The price bid for miscellaneous concrete shall include and cover furnishing, placing and testing miscellaneous 4,000 PSI concrete, including forming and all other incidental work, for cradle or other construction not included as a part of other pay items. This bid item includes 6 inch concrete encasement of existing utilities where required. This bid item is to be used only if and as directed by Engineer.
- B. All accessory and incidental work.
- C. Measurement for quantities of miscellaneous concrete will be based upon the authorized depth, width and length of concrete placement.

- D. Payment for all work in connection with miscellaneous concrete will be made at the appropriate unit price bid for the volume of concrete actually furnished and placed within the limits defined and as authorized by the Engineer.

BID ALTERNATE:

2.7 BID ITEMS FOR FURNISHING AND INSTALLING CONVEYOR EXTENSION COMPLETE (Bid Item No. 7)

- A. The price bid shall include and cover all costs of furnishing, delivering and installing all items as required for the complete construction of the conveyor extension to the adjacent sludge drying beds as provided in the contract documents. This bid item includes but is not limited to all items as shown in the contract documents and deemed reasonable and necessary for completion of the project.
- B. All accessory and incidental work as shown or required within the contract documents.
- C. Payment for all work associated with this item will be made at the lump sum price bid. Partial payment shall be made based on a schedule of values prepared by the contractor and approved by the Engineer. Partial payment shall be proportioned in accordance with work completed.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Preconstruction conference
2. Construction Progress meetings
3. Project closeout conferences

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PRECONSTRUCTION CONFERENCE

A preconstruction conference will be scheduled as soon as possible after the Contract signing, the ENGINEER will schedule a preconstruction conference to be held at the PROJECT Site or office of the OWNER. The preconstruction conference shall be attended by one top ranking officer of the construction company, Contractor's PROJECT superintendent, ENGINEER, OWNER, and all interested parties including but not limited to Local, County, State, or Federal Agencies. The purpose of the meeting shall be to establish PROJECT administrative criteria, review the Contractor's requirements, and to discuss construction schedules and methods. The agenda for the conference will generally include the following topics:

1. Responsibilities of the OWNER
2. Responsibilities of consulting ENGINEER
3. Responsibilities of the Contractor
4. Responsibilities of the funding agency (If Applicable)
5. Coordination of utility work
6. Processing pay requests
7. Discussion of contractor's schedule (Must be submitted 7 days prior to meeting)
8. Review of subcontractors
9. Submittals
10. Change order procedures
11. Safety
12. Labor and equal employment requirements
13. PROJECT inspection (If Applicable)
14. Rights-of-way and easements
15. PROJECT sign (If Applicable)
16. Coordination between contractors
17. Other items on the ENGINEERS agenda

3.2 CONSTRUCTION PROGRESS MEETINGS

- A. Progress meetings shall be held on a monthly basis or at other times during the execution of the Contract at the request of the parties involved. The meeting will be held at the PROJECT site or other location designated by ENGINEER. The contractor shall be represented by the PROJECT superintendent at all meetings and by a ranking officer if so requested by the ENGINEER or the OWNER. The Contractor shall schedule the attendance of management personnel, subcontractors and/or equipment suppliers as may be necessary from time to time to resolve issues that may arise.
- B. The ENGINEER may call additional progress meetings at critical times in the PROJECT.
- C. Representatives of the Contractor's suppliers and subcontractors shall be persons familiar with the details of the work. They shall be persons authorized to make commitments on matters of work progress, delivery dates, size of labor force, cost and other matters as necessary to expedite the work and resolve conflicts.
- D. Contractor shall provide attendance by authorized representatives of the Contractor and all major subcontractors that have performed work over the prior month or will be performing work in the upcoming month.

3.3 PROJECT CLOSEOUT CONFERENCE

- A. The ENGINEER shall schedule a PROJECT closeout conference during the final phases of the work. The purpose of the meeting will be to discuss administrative aspects of the PROJECT closeout including duties of the Contractor with respect to PROJECT acceptance, warranties, post construction services, final inspection, final payment, punch list, and other items on the agenda. The Contractor, ENGINEER, participating funding agencies and the OWNER shall be in attendance.

3.4 MEETING MINUTES

The ENGINEER may keep minutes of PROJECT meetings and will distribute copies to all parties present at meeting or listed on a permanent list of concerned parties.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Construction record color photographs and color video during the course of the Work.

1.2 PHOTOGRAPHY REQUIRED

- A. Take a comprehensive photographic survey and video taping of the existing facility and site(s) before beginning operations to be used to document the condition of the facilities prior to beginning work.
- B. Video tape preconstruction and final construction of separate DVD.
- C. Take photographs at one-month intervals during construction. Photographs of any month need only to show the new work for that month. Photographs shall be clear and of high-quality resolution; minimum 5 megapixels. Provide CD-ROM for photographic information.
- D. CD-ROM and DVD become property of the OWNER.
- E. Additional photography
 - 1. Monthly progress photographs consisting of four (4) high quality photographs on glossy photographic paper. The photos shall be 8.5" x 11" and contain a description of the photo on the back of the photo. High quality digital photos can be submitted in lieu of hard copies.

1.3 COSTS OF PHOTOGRAPHY

- A. Contractor to pay all costs associated with photography CD-ROM, video DVD and prints
 - 1. Parties requiring additional photography or prints shall pay for them directly.
- B. Should Contractor fail to deliver photographs on schedule, OWNER will hire the photograph work and deduct cost from payments due the Contractor.

1.4 DELIVERY OF PHOTOGRAPHY AND VIDEO

- A. Before construction begins, deliver photography CD-ROM and video DVD of site prior to construction.
- B. Deliver current photography CD-ROM to the ENGINEER with monthly pay requests.
- C. Deliver digital photographs on CD-ROM in protective case. Deliver video tapes in DVD within protective case with complete, descriptive labeling.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TECHNIQUE

- A. Factual presentation
- B. Correct exposure and focus
 - 1. High resolution and sharpness
 - 2. Maximum depth-of-field
 - 3. Minimum distortion
- C. Video taping
 - 1. Do not walk while taping, zoom in/out, pan slowly the required directions. Stop taping, walk to next location and begin again.
 - 2. Provide necessary comments during taping.
 - 3. Use machine which can imprint date onto tape.

3.2 VIEWS REQUIRED

- A. Photograph from locations to adequately illustrate the condition of construction and the state of the PROJECT
 - 1. Photographic survey of the facility or site, preconstruction and final construction
 - a. Show all items of equipment
 - b. Show all areas to be modified
 - c. Show all areas in which Contractor will conduct operations or store equipment
 - d. Up to 144 views or as deemed necessary by the ENGINEER or OWNER
 - 2. Monthly photographs
 - a. Up to 48 views or as deemed necessary by the ENGINEER or OWNER
 - b. View as designated by the ENGINEER or OWNER
- B. Identify each print on the bottom front for digital photos, listing the following:
 - 1. Name of PROJECT
 - 2. Orientation of view
 - 3. Date and time of exposure
 - 4. Number photo corresponding to negatives of that group
- C. Identify each video DVD on the tape sheath, the tape itself and the beginning of the tape through recording
 - 1. Name of PROJECT
 - 2. Explanation in detail the different camera views.

3. Date and time of exposure, use both verbal and mechanical devices available.
4. Start video tapes at counter 0+00.

D. Quantities

1. Provide two photos CD-ROM
2. Provide two video DVD

E. ENGINEER will distribute after review:

1. One copy of each view to OWNER (CD-ROM and DVD)
2. One copy of each view to ENGINEER's file (CD-ROM and DVD)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.0 DESCRIPTION

Work Included:

- A. Schedule of Values
- B. Construction Schedule
- C. Survey and Layout Data
- D. Traffic Control Plan
- E. Shop Drawings
- F. Certificates of Compliance
- G. Certified Payrolls
- H. Record of Testing
- I. Record Drawings
- J. Samples
- K. Construction Photographs
- L. O&M Manuals
- M. Release of Liens
- N. Warranties and Guarantees

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

- A. A schedule of values of the various parts of the work to be done under lump sum items shall be agreed upon by the Contractor and the ENGINEER. One week prior to the preconstruction conference, the Contractor shall submit for approval a proposed breakdown into construction categories of their lump sum price bid. This breakdown shall add up to the full 100% value of the lump sum price, and all parts of it shall be covered by the performance bond. The approved breakdown shall be used for the purpose of arriving

at a basis for monthly estimates for appropriate lump sum bid items.

3.2 CONSTRUCTION SCHEDULE

- A. The construction schedule and chart shall be submitted to the ENGINEER for approval one week prior to the preconstruction conference. The general schedule will be discussed at the preconstruction meeting and copies made available to all interested parties. No construction shall be permitted until the construction schedule is approved.
- B. The Contractor shall develop a critical path construction schedule and chart that shows at a minimum a bar graph indicating the series of activities either separately or concurrently required to complete the PROJECT within the allotted time. The chart shall also indicate expected cash flows on a monthly basis. Room shall be provided on the chart whereby the Contractor can plot actual progress of the work against that initially proposed.
- C. The Contractor shall update the schedule on a monthly basis and submit the revised schedule to the ENGINEER along with the monthly pay request.
- D. The Contractor shall furnish the ENGINEER at least five (5) days prior to the start of construction a final list of subcontractors and major suppliers that will be used on the PROJECT.

3.3 SURVEY & LAYOUT DATA

- A. The Contractor shall furnish the ENGINEER at least five days prior to the start of construction two record copies of line and grade stake out data. The furnishing of such record data, despite any action or lack thereof on the part of the ENGINEER relative to the data furnished, shall in no way release the Contractor from their responsibility for the completeness and accuracy of stake out work necessary for construction.
- B. All survey and stake out work shall be done by qualified persons. Surveyor shall be licensed in the state where the PROJECT is located. The Contractor is responsible for stake out of all facilities required by this contract within the prices bid.
- C. Any benchmarks destroyed through or as a direct result of the Contractor's construction operations shall be replaced and/or restored at their expense with no additional cost to the OWNER.
- D. Work done by the Contractor without them having first established proper line and grade, or work done by them to incorrect line and grade, may be ordered removed and replaced at no increase in contract price.

3.4 TRAFFIC CONTROL PLAN

At least ten (10) days prior to the start of construction the Contractor shall furnish the ENGINEER a Traffic Control Plan in accordance with the most recent Maryland Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, including Temporary Traffic Control.

3.5 SHOP DRAWINGS

- A. The Contractor shall submit to the ENGINEER layout drawings for the installation and erection of the work and shop drawings for all fabricated or manufactured articles to be used in the work. The Contractor shall have three (3) copies prepared for submittal to the ENGINEER and shall prepare whatever additional copies as may be necessary or required for their own use and/or use by equipment suppliers and subcontractors.
- B. All data, drawings, and correspondence from subcontractors, manufacturers, or suppliers shall be routed through the Contractor. The ENGINEER shall review only such data and details as are transmitted to them by the Contractor. All correspondence from the Contractor to the ENGINEER shall refer to the appropriate section of these specifications containing the subject matter of the inquiry.
- C. Detailed shop drawings, shall include; as many of the following as applicable: drawing, detail, section, sub-part, paragraph, sub-paragraph, sub-sub-paragraph to specifically identifying where the submitted equipment can be found in the Contract Documents; detailed materials lists and dimensional drawings, data, and literature for fabricated materials or equipment to be incorporated in the work. Include method for mounting for equipment and any alternations required due to removal, replacement or repair of existing equipment. Include all specific data that may be required for ascertaining the excellence and character of the equipment and the space occupied. Shop drawings shall be submitted to the ENGINEER for review for general compliance with the Contract Documents before fabrication. The Contractor shall obtain and check manufacturers shop drawings, certified prints and other pertinent data for conformance with all requirements with the Drawings and Specifications and in ample time to permit satisfactory progress of the work. After a completion of such check and verification by the Contractor, the Contractor shall sign or stamp such drawings, which stamp shall state as follows:

CHECKED BY: _____
(Contractors Name)

SIGNED BY: _____
(Checkers Name)

- D. All data, drawings, and correspondence from subcontractors, manufacturers, or suppliers shall be routed through the Contractor. The ENGINEER shall review only such data and details as are transmitted to them by the Contractor. All correspondence from the Contractor to the ENGINEER shall refer to the appropriate section of these specifications containing the subject matter of the inquiry.
- E. The ENGINEER's review of layout and shop drawings will be only to verify general compliance with Contract Documents. Figure dimensions and other detail will not be checked. Any notation made on shop drawings by the ENGINEER shall be for the Contractor's guidance but shall not relieve the Contractor from their responsibility to re-check, verify and resolve items so noted. The ENGINEERs review of shop drawings shall not relieve the Contractor from responsibility for errors or omissions thereon, whether or not called to the attention of the Contractor by the ENGINEER.
- F. The Contractor's attention is specifically directed to the fact that no work shall be fabricated, nor equipment or materials ordered, nor any construction performed prior to approval by the ENGINEER of shop drawings applicable thereto. Construction performed

in violation of this requirement will be neither approved nor certified for payment until applicable shop drawings have been submitted and approved. If any equipment or materials are ordered by the Contractor prior to submission and approval of shop drawings, they do so at their own risk.

- G. The ENGINEER shall review at no charge to the Contractor shop drawings originally submitted and one re-submittal. Additional reviews resulting from improper submittal, lack of requested information, or disapproval shall be billed to the Contractor by the ENGINEER. The Contractor shall notify the ENGINEER in writing at the time of submission of any deviation in submittals from the requirements of the Contract Documents.
- H. To expedite the return of shop drawings to the Contractor, the Contractor may need to pay extra for overnight delivery. The Contractor will be expected to provide their account number for such service and will be expected to include such costs within the base prices bid.

3.6 CERTIFICATES OF COMPLIANCE

Any certificates required for demonstrating proof of compliance of materials with Specifications requirements shall be executed in three (3) copies plus the number to be returned to the Contractor. Each certificate shall be signed by an authorized officer of the manufacturing company and shall contain the name and address of the Contractor, the PROJECT name and location, the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed of relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

3.7 CERTIFIED PAYROLLS

The Contractor shall provide Certified Payrolls on a monthly basis with the Payment Requests. It is the sole responsibility of the Contractor that payrolls are compliant with the most current Davis Bacon Act requirements. These documents will be kept by the OWNER for PROJECT Records.

3.8 RECORDS OF TESTING

- A. The Contractor shall maintain records of all testing performed during the life of the PROJECT.
- B. Records shall indicate the line, date of testing, persons involved in the testing and the results.
- C. At the end of the PROJECT, or more frequently if requested, all testing records shall be turned over to the ENGINEER.

3.9 RECORD DRAWINGS

The Contractor shall keep one copy of the drawings at the site, in good order and provide mark-up to show all changes made during construction. These record drawings shall be available to the ENGINEER and shall be delivered to them upon completion of the contract. Record drawings shall

contain stationing of all valves, bends, and fittings or dimensions from structures. They shall also contain all as-built elevations. All survey and stake out work shall be done by qualified persons. Surveyor shall be licensed in the state where the PROJECT is located.

3.10 SAMPLES

- A. The number and type of samples submitted shall be specified in the particular section to which they apply.
- B. Samples shall be physical samples to illustrate the materials and workmanship. They shall be submitted in sufficient size and quantity to clearly illustrate the functional characteristics of the product or material, with integrally related parts and attachment devices, and the full range of color to be provided.
- C. All samples shall have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, and any pertinent catalog numbers indicating the intended use.

3.11 CONSTRUCTION PHOTOGRAPHS

- A. Photographs shall be taken at each of the following stages of construction:
 - 1. Before commencement of construction.
 - 2. At one-month intervals during construction of the facilities. Photographs of any month need only show the new work for that month.
 - 3. Upon completion of construction.
- B. Exterior photographs shall be taken from vantage points to view each structure and show all work adequately. Interior photographs shall be taken from vantage points to show all work. The number of photographs required at each monthly interval will be determined by the number of photographs needed to show all work adequately.
- C. The Contractor shall deliver to the ENGINEER a CD with all pictures taken and three (3) sets of four 8" x 10" color photographs per month representing four different views selected by the OWNER or ENGINEER. The OWNER or ENGINEER will select photographs for enlargement from the monthly set of interior and exterior photographs supplied by the Contractor. The Contractor shall therefore maintain and catalog photograph negatives for later use in enlargements.
- D. The photographs shall be clear and of high-quality resolution.

3.12 OPERATION & MAINTENANCE MANUALS

- A. The Contractor shall furnish the ENGINEER six copies and digital portable document format (PDF) of a complete instruction manual for installation, operation, maintenance and lubrication of each component of mechanical and electrical equipment. The Contractor shall submit to the ENGINEER all manuals within thirty days after shop drawing approval, in accordance with the requirements specified herein. The OWNER will retain a minimum of 5% of the contract price until after such time that operation and maintenance manuals have been submitted to the ENGINEER, reviewed for completeness and approved.
- B. Manuals shall include operating and maintenance information on all systems and items of

equipment. The data shall consist of catalogs; brochures; bulletins; charts; schedules; equipment numbers; wiring diagrams and assembly drawings which shall describe location, operation, maintenance, lubrication, and operating weight; lubrication charts showing manufacturer recommended lubricants for each rotating or reciprocating unit; and other necessary information for the OWNER to establish a complete maintenance program.

C. The following items shall also be submitted:

1. Complete name plate data including serial number for each piece of equipment.
2. Manufacturer's cuts and dimensional drawings of each piece of equipment and details of all replacement parts.
3. Manufacturer's name, address and phone number for service and parts along with the name, address and phone number of the nearest service representative for the manufacturer.
4. A list of spare parts including part numbers and other information needed to order parts.
5. Complete electrical wiring diagrams.
6. Routine maintenance schedule including lubrication, adjustments, inspections, calibrations, etc. and a list of acceptable equivalent lubricants which are available locally.
7. Written warranties. Each written warranty shall be certified to extend the warranty to the length of time covered under the Contractor's one year guaranteed period.

D. Operation and maintenance manuals shall be bound within a three-ring type plastic coated binder. Maximum size shall be 8-1/2" x 11 x 2-1/2". Multiple binders shall be labeled and organized into volumes. Each volume shall be labeled and organized into sections. Each section shall be for only one piece of equipment. Each section shall include as a minimum, installation, operation, maintenance, and lubrication data for the equipment item. Section dividers shall be clearly labeled with tabs and permanent lettering. Each binder shall be D-ring type with clear plastic pockets for full length and width of spine and cover, and sheet lifters. Provide and insert custom, full insertion label for spine and cover. Coordinate with OWNER for design of labels.

E. Provide two additional copies of specific equipment manuals at least two weeks prior to operation and training.

3.13 RELEASE OF LIENS

Affidavits of payments of all bills related to the PROJECT, release of liens, bonding company approvals and consent of surety to final payment.

3.14 WARRANTIES AND GUARANTEES

The Contractor shall provide all release of liens, warranties, guarantees, bonds, and affidavits required for equipment and the total PROJECT in accordance with these specifications. The Contractor shall provide a Release of Liens from all subcontractors and material suppliers.

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS AND ACRONYMS

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Where "as shown", "as indicated", "as detailed", or words of similar import are used it is understood that reference to the drawings accompanying this specification is made unless stated otherwise.
- B. Where "as directed", "as required", "as selected", "permitted", "acceptance", or words of similar import are used, it is understood that direction, requirement, selection, permission or acceptance by the ENGINEER and compliance with codes and regulations are intended unless stated otherwise.
- C. Where used "provide" is understood to mean "provide complete in place" that is, "furnished and installed".
- D. Where "items of material, equipment, work, etc.", and "methods of installation, finish, and accomplishment, etc." are referred to in this specification it is understood to refer to all such "items, materials, equipment, work, finish, etc."
- E. Where "equal to", "or equal", or "approved equal" are used, the Contractor may substitute a product or material, which in the judgment of the ENGINEER, expressed in writing, is equal to that specified.
- F. The term "Beneficial Occupancy" is interchangeable with the term "Substantial Completion". A state of beneficial occupancy will be reached when all work is complete, accessible, operable and usable by the OWNER; all parts, systems and site work is 100% complete and cleaned for the OWNER's full use. Only incidental corrective work under "Punch Lists" and final cleaning may remain for Final Completion.

1.2 SPECIFICATION REFERENCE

- A. Materials or operations specified by reference to specification of a manufacturer or society or institute or other standard must comply with requirements of current specification or standard listed.
- B. In case of conflict between referenced specifications or standard, the one having the more stringent requirement governs.

1.3 INSTITUTE, SOCIETY, ASSOCIATION AND STANDARDS ABBREVIATION

AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway Officials
ACI	American Concrete Institute
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute

APA	American Plywood Association
ASTM	American Society for Testing Materials
AWS	American Welding Society
CDBG	Community Development Block Grant
CLFMA	Chain Link Fence Manufacturer's Association
CRA	Commercial Standard
FM	Factory Mutual
FS	Federal Standard
MDE	Maryland Department of the Environment
NEC	National Electric Code
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturer's Association
OSHA	Occupational Safety and Health Act
PCI	Prestressed Concrete Institute
PS	Product Standard
SDI	Steel Door Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UL	Underwriter's Laboratories, Inc.

Not all of the above names are referenced in the specifications.

PART 2 – PRODUCT (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. TEMPORARY FACILITIES

1. The Contractor shall furnish and maintain, during construction of the PROJECT, adequate facilities at the site for the use of the OWNER, ENGINEER and themselves as set forth below. Upon completion of the PROJECT, or as directed by the ENGINEER, the Contractor shall remove all such temporary structures and facilities from the site, same to become their property and leave the premises in the condition required by the Contract.
2. The Contractor and their subcontractors may maintain temporary facilities on the site in addition to those specified as may be necessary for the proper conduct of the work. These shall be located so as to cause no interference to any Contract work.

B. TEMPORARY OFFICE

1. The Contractor shall provide prior to the start of any construction and, within the prices bid for mobilization and demobilization, a suitable field office in an approved location in the immediate vicinity of the PROJECT for sole use by the ENGINEER, and the R.P.R. The office shall be a trailer or suitable building setup, equipped and made ready for use prior to the beginning of work on the PROJECT and shall remain until all field records pertinent to the PROJECT have been completed. The office shall be equipped with a telephone listed in the Contractor's name, and other facilities as the Contractor may require. The Contractor shall, within the unit price bid and without extra cost to the OWNER, pay all costs of operating and maintaining the field office including but not limited to charges for electric and telephone service, sanitary facilities, heating, etc.
2. The field office shall be equipped with at least two office-type desks, one drafting table, two double-drawer fire resistant file cabinets, five chairs, one fax machine on separate line from telephone, one approved first aid kit, one (1) water cooler with cold water, and one approved fire extinguisher. The field office shall be heated during cold weather and have sufficient window area to furnish natural light. The windows shall be screened and constructed to open and close for ventilation. The office shall be suitably air conditioned during summer months. The office shall be provided with sanitary toilet accommodations. Minimum office floor space shall be 300 square feet.
3. The Contractor shall maintain the field office in good condition and appearance for the duration of the PROJECT. It shall be removed when the PROJECT is complete and the site cleaned up and left in a neat and acceptable manner.

C. TEMPORARY SANITARY FACILITIES

1. Construct or provide portable toilet facilities to provide natural light and ventilation, or artificial light and mechanical ventilation at both the on-site and

- off-site locations.
- 2. Provide adequate temporary outside toilet facilities for use of persons working at site.
- 3. Maintain toilets clean and in sanitary condition. Provide toilet tissue in suitable holder.
- 4. Remove temporary toilets when suitable facilities are available within the building or when construction is complete.

D. TEMPORARY WATER SERVICE

- 1. Permanent-type connections may be made by Contractor for their use if piping is returned to original condition at completion.
- 2. Take positive measures to preclude cross-connections and backflow.
- 3. The OWNER will assume cost of water consumed for sanitary facilities if responsible care and restraint is exercised by the Contractor in its use.

E. TEMPORARY ELECTRICAL SERVICE

- 1. The Contractor shall make all necessary arrangements for temporary electricity for construction purposes, and furnish at their own expense, all temporary wiring, lamps, and accessories required for the completion of the work. Costs for electrical service shall be paid by the contractor.

F. TEMPORARY HEATING

- 1. The General Contractor will provide safe, clean temporary heating for the work of each trade for the entire PROJECT duration when required for proper installation of materials and working conditions, except as noted below.
- 2. The General Contractor shall pay costs of equipment, maintenance and fuel for all temporary heating operations.
- 3. Open fires are not permitted.
- 4. Methods of temporary heating shall be approved by the OWNER and all governing agencies having legal jurisdiction.

G. EXISTING UTILITIES

- 1. Prior to the closeout of the PROJECT, the Contractor shall remove all temporary connections and return all sources to their original conditions prior to commencement of the work.

H. TEMPORARY APPROACHES

- 1. The Contractor shall provide all necessary temporary approaches and exits as required to properly execute the work, and as indicated on the Drawings.
- 2. The Contractor shall keep streets, drives, walks, and corridors, adjacent to and on the site, clean of all dirt, debris and litter caused by construction operations for this PROJECT. A clean-up shall be accomplished at end of days work.

I. CLEAN-UP

- 1. The Contractor shall keep streets, drives, walks, and corridors, adjacent to and on the site, clean of all dirt, debris and litter caused by construction operations for

this PROJECT. A clean-up operation shall be accomplished at the end of each day's work.

2. The Contractor shall, at their own expense, keep the sites of their operations clean during construction and remove all rubbish as it accumulates. Daily brush cleaning of roadway sections with on-going construction activities shall be performed. The Contractor shall remove waste materials, debris, and rubbish from site periodically and dispose of at legal disposal areas away from the site. The Contractor shall provide dust control on the PROJECT site as needed. The Contractor shall also:
 - a. Clean staining or reactive materials from affected surfaces immediately during course of work. Particular care shall be taken to remove plaster, mortar, and paint from metal surfaces immediately.
 - b. Clean the work as it progresses to minimize the collection of dust and debris in inaccessible spaces, color change or staining of finishes, and hardening of curing-type dirt and stains.
 - c. Clean on a daily basis all areas used for construction traffic. Where dropping from debris carts, concrete buggies affect traffic, assign full time labor to keep public traffic moving freely under clean, unobstructed conditions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 77 19

CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. The items listed herein shall be compiled and prepared by the Contractor prior to completion of all work and delivered within one month of date of substantial completion to the OWNER for their future use.
- B. Final payment to the Contractor will be withheld until all items listed herein are delivered to the OWNER.
- C. Submit all items specified herein to the ENGINEER for review prior to delivery to the OWNER. All items specified herein shall be submitted to the ENGINEER in accordance with Section 01 33 00, Submittal Procedures. Make any corrections, additions or deletions from the contents thereof as may be required by the ENGINEER.

1.2 RECORD DRAWINGS

- A. The Contractor shall keep a current record of all changes made during construction, including mechanical and electrical lines and apparatus. The record drawings shall show the location of all permanently concealed work not installed where indicated on the Contract Documents. Redline record drawings shall be kept up to date every week and submitted to the ENGINEER upon request.
- B. Accuracy of information shall be the sole responsibility of the Contractor. Drawings shall be prepared at the same scale as the Contract Documents. Copies of the Contract Drawings may be obtained from the ENGINEER. The cost of reproduction and shipping shall be paid for by the Contractor.

1.3 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall provide all equipment manufacturer issued operation and maintenance manuals specific to supplied equipment; general operation and maintenance manuals will not be accepted.
- B. The Contractor shall provide certification in the form of a manufacturer's certificate or letter stating equipment was installed per manufacturers recommendations and was successfully put in to operation.

1.4 WARRANTY

The Contractor shall provide all guarantees required for equipment and the total project as hereinbefore specified.

1.5 RELEASE OF LIENS

Affidavits of payments of all bills related to the PROJECT, release of liens, bonding company

approvals and consent of surety to final payment.

1.6 SUPPLY

Supply extra material supplies and spare parts as called for throughout specification

1.7 FINAL CLEAN-UP

- A. Perform general cleanup before final inspection.
- B. Remove rubbish.
- C. Remove stains, marks, and dirt from all paved surfaces.
- D. Thoroughly clean debris from the sewer system.
- E. Provide brush cleaning of roadways.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 00 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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 specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the Following:
 - 1. Section 03 35 00 "Concrete Finishing"
 - 2. Section 03 15 13: "Waterstops"

1.3 DEFINITIONS

Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, pozzolans, and ground granulated blast-furnace slag. Materials shall be in accordance with ACI 232.2 R-18 and ACI 233 R-17.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, PROJECT conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shrinkage Limitation Certification: For fluid retaining structures concrete mixes, lab tests shall be in accordance with 2.12 I. Shrinkage limitation certification shall be submitted to certify concrete mix limits shrinkage to specified levels.
- D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- E. Drawings-Fabrication/Erection/Installation: Drawings for reinforcement and accessories, without reference to the contract drawings.

- F. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- G. Welding Certificates: Copies of certificates for welding procedures and personnel.
- H. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- I. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Admixtures.
 - 5. Curing materials.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Joint-filler strips.
- J. Minutes of pre-installation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work 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.
- B. 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 formwork and shoring and re-shoring installations that are similar to those indicated for this PROJECT in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
 - 2. Material manufacturers shall be ISO 9001/9002 registered proof of documented quality assurance system. Quality system must be independent auditing registrar. ISO 9001/9002 certification shall be included with material submittals.

- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 2. ACI 211, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."
 - 3. ACI 212, "Chemical Admixtures for Concrete."
 - 4. ACI 232.2R-18, "Use of Fly Ash in Concrete."
 - 5. ACI 233R-17, "Ground Granulated Blast Furnace Slag as a Cementitious Constituent in Concrete."
 - 6. ACI 301, "Specification for Structural Concrete."
 - 7. ACI 302.1R, "Guide for Concrete Floor Slab Construction."
 - 8. ACI 305R, "Hot Weather Concreting."
 - 9. ACI 306R, "Cold Weather Concreting."
 - 10. ACI 308, "Standard Practice for Curing Concrete."
 - 11. ACI 309R, "Guide for Consolidation of Concrete."
 - 12. ACI 315, "Details and Detailing of Concrete Reinforcement," latest edition.
 - 13. ACI 318, "Building Code Requirements for Reinforced Concrete," latest edition.
 - 14. ACI 347, "Recommended Practice for Concrete Form Work."
- H. Preinstallation Conference: Conduct conference at PROJECT site to comply with requirements in Division 1 Section "Project Meetings."
 - 1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.
 - e. Laboratory responsible for field quality control.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Avoid damaging coatings on steel reinforcement.
 - 2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D3963/D3963M

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Plywood, metal, or other approved panel materials.
 - 1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 2. Structural 1, B-B, or better, mill oiled and edge sealed, not less than 5/8" (16 mm) thick.
- C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- H. Furnish units that will leave no corrodible metal closer than 1½ inch (38 mm) to the plane of the exposed concrete surface.
- I. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M (where indicated).
- C. Steel Bar Mats: ASTM A184/A184M, assembled with clips.
 - 1. Steel Reinforcement: ASTM A615/A615M, Grade 60 (Grade 420), deformed bars.
- D. Deformed-Steel Welded Wire Fabric: ASTM A497, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60, (where indicated).
- C. Epoxy Repair Coating: Liquid, two part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I/II.
- B. Normal-Weight Aggregate: ASTM C33, uniformly graded, and as follows:
 - 1. Nominal Maximum Aggregate Size: 3/4 inches).
- C. Water: Potable and complying with ASTM C94.

2.5 ADMIXTURES

- A. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures. Provide one of the following:

"AEA-92" or "Air Mix 200"	The Euclid Chemical Co.
"Pozzolith Normal"	Master Builders
"WRDA"	W.R. Grace Co.
"Plastocrete 160"	Sika Chemical Corp.

- B. Water Reducing Admixture: ASTM C494, Type A, and containing not more than 0.05 percent chloride ions. Provide one of the following:

"Eucon WR" Series	The Euclid Chemical Co.
"Pozzolith Normal"	Master Builders
"WRDA"	W.R. Grace Co.
"Plastocrete 160"	Sika Chemical Corp.

- C. High Range, Water Reducing Admixture (Superplasticizer): ASTM C494, Type F or Type G and containing not more than 0.05 percent chloride ions. Provide one of the following:

"Eucon 37" or "Eucon 537"	The Euclid Chemical Co.
"Rheobuild 1000"	Master Builders
"Daracem 100"	W.R. Grace Co.
"Sikament 3000"	Sika Chemical Corp.

- D. Non-Chloride, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Provide one of the following:

"Accelguard 80"	The Euclid Chemical Co.
"Pozzutec 20"	Master Builders
"Daraset"	W.R. Grace Co.

- E. Water-Reducing and Retarding Admixture: ASTM C494, Type D, and contain not more than 0.05 percent chloride ions. Provide one of the following:

"Eucon Retarder 75"	The Euclid Chemical Co.
"Pozzolith Retarder"	Master Builders
"Daratard 17"	W.R. Grace Co.
"Plastiment"	Sika Chemical Co.

- F. Mid-Range Water-Reducing Admixture: ASTM C494, Type A and containing no more than 0.05 percent chloride ions. Provide one of the following:

"Eucon MR"	The Euclid Chemical Co.
"Polyheed"	Master Builders, Inc.

- G. Corrosion - Inhibiting Admixture (fluid retaining structures): Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DCI or DCI-S; W.R. Grace and Co., Construction Products Division
 - b. Rheocrete 222 and; Master Builders, Inc.

- c. FerroGard-901; Sika Corporation.
- d. Eucon CTA; Euclid Chemical Company.

2.6 WATERSTOPS

- A. [Reference Section 031513: "Waterstops"](#)

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Manufacturers:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. GAF Materials LLC.
 - c. Stego Industries, LLC.
 - d. W.R. Meadows, Inc.
 - 2. Substitutions: See Substitution procedures in front end specification
- A. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; meeting deleterious substance limits of ASTM C33 for fine aggregates.

2.8 FLOOR AND SLAB TREATMENTS

- A. All building floor slabs shall receive floor hardener unless otherwise noted.
- B. Reference Section 033500: "Concrete Finishing".

2.9 CURING MATERIALS

- A. All concrete work shall be properly cured in accordance with ACI recommendations.
- B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- D. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- E. Water: Potable.

- F. Clear, Waterborne, Membrane-Forming Curing Compound (VOC Compliant): ASTM C309, Type 1, Class B. The compound shall have a minimum of 18 percent solids and a maximum moisture loss of 0.039 grams per square cm. when applied at a coverage rate of 250 sq. ft. per gallon. Actual application rate shall be 150 to 200 sq. ft. per gallon depending on atmospheric conditions.
- G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound (VOC Compliant): ASTM C1315, Type 1, Class A. The compound shall have a minimum of 18 percent solids and a maximum moisture loss of 0.039 grams per square cm. when applied at a coverage rate of 250 sq. ft. per gallon. Actual application rate shall be 150 to 200 sq. ft. per gallon depending on atmospheric conditions.
- H. Products: Subject to compliance with requirements, provide one of the following approved products:
 - 1. Evaporation Retarder:
 - a. Eucobar; Euclid Chemical Co.
 - b. Confilm; Master Builders, Inc.
 - c. SikaFilm; Sika Corporation.
 - 2. Clear, Waterborne, Membrane-Forming Curing Compound:
 - a. Kurez VOX; Euclid Chemical Co.
 - b. Vocomp-20; W. R. Meadows, Inc.
 - 3. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
 - a. Vocomp-30; W. R. Meadows, Inc.
 - b. Super Diamond Clear VOX; Euclid Chemical Co.
 - c. Super Aqua-Cure VOX; Euclid Chemical Co.

2.10 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type: Class I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

- E. Anti-Corrosion Epoxy Adhesive: Water-based epoxy resin for adhesion and corrosion protection of reinforcing members (24 hour maximum open time). Products: Subject to compliance with requirements, providing one of the following:
 - 1. Corr-Bond; Euclid Chemical Co.
 - 2. Armatex 110; Sika Corp.

2.11 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Footings and Grade Beams: As indicated on drawings
- D. Slabs on Grade and Pedestals: As indicated on drawings
- E. Sidewalks: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 days): 4000 psi.
 - 2. Minimum Cementitious Materials Content: 560 lb/cu. yd. for concretes with a maximum aggregate size of 3/4".
 - 3. Maximum Slump: 4 inches (100 mm).
- F. Walls, structural base slabs, retaining walls, retaining wall footings, fluid retaining structures, and Other Structural Members: Proportion normal-weight concrete mix as follows:
 - 1. As indicated on drawings
 - 2. Minimum Cementitious Materials Content: 560 lb/cu. yd. for concretes with a maximum aggregate size of 3/4".
 - 3. Maximum Slump: 4 inches (100 mm).
 - 4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2-inch slump, showing no signs of segregation.
- G. Shrinkage Limitation: Concrete designated on the drawings to be "Crack Critical" shall be one of the following. Contractor shall perform laboratory test for certification well in advance to avoid delays in the PROJECT.
 - 1. Concrete mix shall be certified to limit shrinkage in accordance with the following:
 - a. A drying shrinkage test shall be conducted on a preliminary trial batch with the maximum water-cementitious materials ratio used to qualify each proposed concrete mix design using the concrete materials, including admixtures that are proposed for the PROJECT. Three test specimens shall be prepared for each test. Drying shrinkage specimens shall be 4 by

4 by 11 inches (100 by 100 by 275 mm) prisms with an effective gauge length of 10 inches (250 mm), fabricated, cured, dried, and measured in accordance with ASTM C157 except with the following modifications:

- b. Specimens shall be removed from the molds at an age of 23 hours at 1 hour after trial batching, shall be placed immediately in water at $73^{\circ}\text{F} \pm 3^{\circ}\text{F}$ ($23^{\circ}\text{C} \pm 2^{\circ}\text{C}$) for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in lime-saturated water as specified in ASTM C157. Measurement to determine expansion expressed as a percentage of original length shall be taken at 7 days. The length at 7 days shall be the base length from drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity controlled room maintained at $73^{\circ}\text{F} \pm 3^{\circ}\text{F}$ ($23^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and $50\% \pm 4\%$ relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be reported separately for 7, 14, and 21 days ± 4 hours of drying from "0" days after 7 days of moist curing.
 - c. Drying shrinkage deformation for each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. Results of the shrinkage test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimens deviates from the average for that test age by more than 0.004 percent, the results for that specimen shall be disregarded.
 - d. The average drying shrinkage of each set of test specimens cast in the laboratory from a trial batch at the 21 days drying age shall not exceed 0.036 percent for concrete to be used in liquid-containing structures and 0.048 percent for concrete to be used in other structures. Drying shrinkage tests will not be required for any additional concrete mixes used for pile caps, isolated footing, pipe blocking, pipe encasement, and building slabs.
- H. Cementitious Materials: Limit percentage, by weight, of cementitious materials (in accordance with ACI 232.2R-18, and ACI 233R-17) other than Portland Cement in concrete as follows:
- 1. Combined Fly Ash and Pozzolan: 25 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 25 percent.
- I. Maximum Water-Cementitious Materials Ratio:
- 1. All concrete unless otherwise noted 0.45
 - 2. Sidewalks 0.50
- J. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1 percent, unless otherwise indicated.
- 1. Air Content: 5.5 percent for 1-1/2-inch- nominal maximum aggregate size.
 - 2. Air Content: 6 percent for 1-inch- nominal maximum aggregate size.

- 3. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.
- K. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- L. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.45.
 - 4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94 and ASTM C1116 and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Mixers: Concrete shall be ready-mixed. Shrink mixing will not be permitted. Transit mixed concrete shall be mixed and have water added only at the site. All mixing equipment must, in the opinion of the inspector, be suitable for the job. A standard type of batch mixer shall be used and no hand mixing will be permitted. Ready-mixed concrete shall conform to ASTM C94. Contractor is to maintain a readily available file of delivery tickets stating design strength, batch time, delivery time, placement time, mix slumps, aggregate and admix (if applicable) and yards delivered for all concrete.
- C. Charging Procedure: Mix shall be kept at a consistency which can be placed readily without segregation. Aggregates shall be measured in grated hoppers by weight, in a manner which can easily be checked. Cement shall be measured by volume or by weight. Air slacked cement or cement which is lumpy, whatever the cause, shall not be used. Worming of cement directly into truck mixers shall not be permitted.
- D. Mixing Procedure: In stationary mixers, mixing time shall be a minimum of ten minutes after addition of water. If an extra charge of water is required because of too low slump, the drum shall be turned a minimum of 30 revolutions after adding such charge. Once initial set has taken place, no attempt shall be made to temper the concrete by the addition

of water. Any concrete so tempered will be rejected and shall be removed from the site. Mixers shall not be charged in excess of the rated speed. Mixer shall be completely discharged before recharging.

- E. Time Limit: When either Type I or Type II Portland cements are in use, the elapse time between the initial contact of the cement with water and the discharge of the batch on the job shall not be more than 1 ½ hours or 300 revolutions.
- F. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating PROJECT identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch (6 mm).
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.

- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.
 - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Aluminum items in contact with concrete shall receive two coats of bitumastic coal tar epoxy.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete or any live loads may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, walls, slabs, and other structural elements, that supports weight of concrete or any live loads in place until concrete has achieved the following:
 - 1. At least 70 percent of 28-day design compressive strength.

- 2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by ENGINEER.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E1643 and manufacturer's written instructions.
- B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to depth of 3/4" to 1 1/2".

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of

adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength, watertightness and appearance of concrete are not impaired, at locations indicated or as approved by ENGINEER. Maximum distance between construction joints shall be forty (40) feet.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 - 2. Locate joints for beams, slabs, and walls in the middle third of spans.
 - 3. Space vertical joints in walls as indicated.
 - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Grooved Joints: For sidewalks and as indicated, form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-(3-mm-) wide joints into concrete as soon as cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint, unless noted otherwise.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in wall to base slab intersections and at other locations indicated, according to manufacturer's written instructions, bonding fastening and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. The subgrade of all slabs shall be thoroughly wetted with water prior to placement of concrete, especially during hot, dry or windy conditions.
- B. Do not add water to concrete during delivery, at PROJECT site, or during placement, unless approved by ENGINEER.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Dropping of concrete over 4 feet or through a cage of reinforcing steel will not be permitted.
- E. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
 - 3. Provide a minimum of 2 vibrators in good working condition on the job at all times.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- G. Concrete shall not be deposited during rain. Concrete shall not be deposited into areas of standing or running water.
- H. Maximum Pours: Maximum length of all pours shall be 40 feet (12.19 m), unless otherwise noted or approved by ENGINEER. All joints shall be as approved by the ENGINEER or as detailed on the drawings. All reinforcement, forms and ground with which concrete is to come in contact, shall be free of frost.
- I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
 4. Protection After Placement: Suitable means as defined in ACI 306 shall be provided for maintaining a temperature in the concrete of at least 50 degrees F for not less than three days after the concrete is placed. For a period of seven days, the concrete shall not be exposed to a temperature below 40 degrees F.
 5. Concrete placement shall be made when air temperature is at least 32 degrees F and rising, unless special precautions acceptable to the ENGINEER,
- J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32.22 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and

patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
- B. Rubbed Finish: Apply the following to smooth-formed finished concrete:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process and mortar used for concrete repair.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot-(3.05-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - a. 1/4 inch (6.4 mm).
- D. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with ENGINEER before application.
- F. Mineral Dry-Shake Floor Hardener Finish: After initial floating, apply mineral dry-shake materials to building slab surfaces according to manufacturer's written instructions and as follows:
 - 1. Uniformly apply mineral dry-shake materials at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m), unless greater amount is recommended by manufacturer.
 - 2. Uniformly distribute approximately two-thirds of mineral dry-shake materials over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second mineral dry-shake application, uniformly distributing remainder of material, and embed by power floating.
 - 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake material manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Take curing measures immediately after casting and extend period according to the ENGINEER's/ARCHITECT's recommendation based upon prevailing temperature, wind, and relative humidity.
 - 1. Keep concrete continuously moist for minimum 14 days after casting.
 - 2. Maintain concrete temperature at minimum 50 degrees Fahrenheit for seven days after casting.

3. Avoid alternate wetting and drying and fluctuations of concrete temperature.
 4. Protect fresh concrete from direct rays of sun, rain, drying winds, soiling, and damage.
 5. Do not permit curing method to affect adversely finished or treatments applied to finished concrete.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions will cause excessive moisture loss before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Curing/Sealing Methods for Slabs: Cure all concrete surfaces with one or a combination of the following methods. Where a specific curing procedure is not specified, at the Contractor's selection, one or more of the following methods shall be used.
1. Water curing: Keep concrete surfaces continuously wet with clean water during the curing period by immersion, maintaining a continuous flow of water over the surface, continuous spraying, continuous sprinkling or a combination of these. For all curing methods, the difference in temperature between the water used for curing and the concrete shall not exceed 20 degrees Fahrenheit.
 2. Wet Coverings: Cover the concrete surfaces with burlap, cotton mats, sand, earth, or other suitable moisture retaining materials and keep these materials saturated during the curing period. Lap all fabrics at least 8 inches at all joints. On exposed concrete, do not use any type covering which will discolor the concrete surface.
 3. Waterproof coverings: As soon as possible after finishing, thoroughly wet the concrete surfaces and cover the concrete surfaces with waterproof paper or plastic film immediately after wetting. For a period or at least 8 hours after the concrete has taken its initial set, maintain a continuous flow of clean water over the concrete surface under the covering. Lap all joints in the covering at least 8 inches and provide weights and other means and methods to keep the waterproof covering in direct contact with the concrete during the curing period.
 4. Membrane forming curing compounds: All exposed interior slabs, not receiving a liquid densifier, and troweled slabs receiving mastic applied adhesives or "shake-on" hardeners shall be cured with the specified curing and sealing compound. Exterior slabs, sidewalks, curbs, and architectural concrete, not receiving a penetrating sealer, shall be cured with the specified clear, non-yellowing curing and sealing compound. Maximum coverage shall be 200 ft²/gallon on steel troweled surfaces and 150 ft²/gallon on floated or broomed surfaces for the curing/sealing compound.
- D. Curing methods for Walls: Cure all concrete walls as follows: Keep forms wet during period forms are required to remain in place. Immediately after formed concrete has taken its initial set, start a gently uniform flow of clean water over concrete to thoroughly wet all concrete surfaces and formwork and maintain this flow of water until forms are removed. Immediately after form removal cure concrete surfaces with one of the curing methods specified above.
- E. Other Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist

cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods listed in paragraph F below.

- F. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 4. Curing and sealing compound below is usually for floors and slabs and may act as a permanent surface finish.
 - 5. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
 - 6. Remove curing compound from concrete surfaces to receive coating, adhesive or other finish, or use alternate curing method.
- G. Do not apply loads to elevated slabs, walls, and beams for 28-days or until approved concrete tests document concrete has reached 100% of specified minimum compressive strength.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and

- complete surface repairs.
- 2. Some manufacturers state that this floor treatment also functions as a curing aid. If used as a cure, delete minimum age of concrete below and revise application method to follow manufacturer's written instructions. Coordinate with "Concrete Protection and Curing" Article. Revise minimum period below to 14 or 28 days if preferred or more if recommended.
- 3. Do not apply to concrete that is less than seven days old.
- 4. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Slump: ASTM C143; one test at point of placement (prior to pumping) for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C231, pressure method, for normal-weight concrete; ASTM C173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F (4.44 deg C) and below and when 80 deg F (26.67 deg C) and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 6. Compression Test Specimens: ASTM C31/C31M;

- a. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - b. Cast and field cure one set of four standard cylinder specimens for each day's pour.
 - c. Cast extra two cylinders for each day's pour (14 day compressive strength)
 - d. Cast two extra cylinders per pour.
- 7. Compressive-Strength Tests: ASTM C39;
 - a. Test two laboratory-cured specimens at 7, two at 14 days, days and two at 28 days.
 - b. Test two field-cured specimens at 7 days, two at 14 days, and two at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Test results shall be reported in writing to ENGINEER, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain PROJECT identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for all tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ENGINEER but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ENGINEER. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by ENGINEER. Contractor shall pay for cored cylinder collections and testing if standard cylinder specimens fail to confirm conformance with the specifications.

END OF SECTION 03 30 00

SECTION 03 35 00

CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Finishing concrete floors
2. Floor surface treatment.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Prepared concrete floors ready to receive finish; control and formed expansion and contraction joints and joint

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete for Buildings.
2. ACI 302.1 - Guide to Concrete Floor and Slab Construction.

B. ASTM International:

1. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
2. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
3. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
4. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
5. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
6. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
7. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.

- B. Coordinate Work of this Section with concrete floor placement and concrete floor curing.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information on concrete hardener, sealer, compatibilities, and limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Qualifications Statements:
 - 1. Submit qualifications for manufacturer and applicator.
 - 2. Submit manufacturer's approval of applicator.

1.5 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Submit information on maintenance renewal of applied coatings.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI 301 and 302.1.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Temporary Lighting:
 1. Light Source: Minimum 200 W.
 2. Quantity: One for each 425 sq. ft. (40 sq. m) of floor being finished.
 3. Placement: 8 feet (2.5 m) above floor surface.
- C. Temporary Heat: Maintain minimum ambient temperature of 50 deg. F (10 deg. C).
- D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources from affecting personnel or concrete.

1.10 WARRANTY

- A. See Division 1 for additional warranty requirements.
- B. Sealer/Hardener: Manufacturer's and Certified Applicator's Joint Agreement for Twenty (20) year material warranty and Five (5) year labor warranty.

PART 2 - PRODUCTS

2.1 COMPOUNDS - HARDENERS AND SEALERS

- A. Penetrating Sealer/Hardener Concrete Floor Finish:
 1. Basis of Design Product: Ashford Formula. Formulated to permanently seal, dustproof, increase abrasion resistance and develop permanent densification to concrete surfaces to which it is applied.
 2. Description: Clear liquid form of silicate to permanently seal, dustproof and harden concrete surfaces and provide abrasion resistance by penetrating into concrete pores and chemically reacting. Chemically relies on an internal reaction, leaving no surface film or residue to densify pores. Products containing silicanates, silicones, and magnesium or lithium silicates will not be acceptable and will not be approved.
 3. Type: Liquid.
 4. Manufacturers:
 - a. Basis of Design: Ashford System as manufactured by Curecrete Chemical Company.
 - b. Substitutions: **Not permitted.**

B. Performance Criteria:

1. ASTM C 779, Abrasion: An improvement of 32.5% over untreated samples after 30 minutes.
2. ASTM D 3359, Surface Adhesion: A 22% increase in adhesion over untreated samples, when tested with epoxy.
3. ASTM C39 Compressive Strength. An increase of 40% over untreated samples after seven days.
4. ASTM C 805 Impact Resistance. An increase of 13.3% over untreated samples when tested by Schmidt Hammer.
5. Permeability: Sealed and treated surface allowed a rate of 0.00073oz. (0.022cc) per hour when tested by a 7-foot (2.13 meter) head of water applied to 4.91 square inch (122224.71mm) area.
6. ASTM C 1028 Friction: No less than 0.86 result of coefficient of friction on sealed and treated dry surfaces and no less than 0.69 result of coefficient of friction on sealed and treated wet surfaces.
7. ASTM G 23 Light Exposure. No adverse effects on sealed and treated samples.
8. TTM-59, Chemical Resistance: No effect when exposed to alcohols, amines, alkaline detergents, ethers, Halogenated hydrocarbons, hydrocarbons, hydraulic fluids, ketones, oils and fuels. Moderate chemical resistance to some inorganic and organic acids.

C. Manufacturer's Technical Representative available to make site visits if requested by Owner's Representative.

D. Sealer/Hardener Concrete Finish Schedule - Special Flooring, (SF-1):

1. First Coat: Ashford Formula applied at 200 SF per gallon. Apply at the time of cure to freshly finished concrete, immediately following the trowel operation and the soft cutting of the joints. Ashford Formula may be used in conjunction with compatible curing methods if approved by the Sealer/Hardener Manufacturer.
2. Spiff Coat: Ashford Formula applied at 1000 SF per gallon. Apply at the end of the project after the final clean of the floor and prior to racking. Allow 24 hour cure and follow with high speed propane burnishing in accordance with the manufacture.

2.2 JOINT SEALANT

A. Product: "Crete Fill" by Curecrete

B. Color: Custom Color as selected by the Owner's Representative.

C. Polyurea Joint sealant, (non-staining) must meet specification requirements for compatibility with Sealer/Hardener Concrete Finish as recommended by manufacturer of concrete Sealer/Hardener.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.
- B. Verify that floor surfaces are acceptable to receive Work of this Section.

3.2 APPLICATION

- A. General:
- B. Concrete Floor Finishing:
 - 1. Comply with ACI 301 and ACI 302.1.
 - 2. Steel-trowel surfaces which are to be exposed.
 - 3. Floor Drains:
 - a. In areas with floor drains, maintain design floor elevation at walls.
 - b. Slope surfaces uniformly to drains at nominal 1/8 in./ft (10 mm/m) minimum, or as indicated on the drawings.
- C. Floor Surface Treatment:
 - 1. Apply Sealer/Hardener Concrete Finish in strict accordance with Manufacturer's latest printed instructions. Utilize manufacturer's recommended equipment for installation. Use low pressure drum pump with high volume sprayer or pour from drums or pails to flood surface during first coat application. Pump up sprayer may be used for applying spiff coat following manufacturer's recommended procedures.
 - 2. Application is to take place prior to any equipment or accessory installation thus allowing as complete and uninhibited concrete slab area for installation.
 - 3. Only Manufacturer's Certified Applicator may apply Sealer/Hardener Concrete Finish. Applicable procedures must be followed as recommended by the Manufacturer.
 - 4. Manufacturer's Certified Applicator to install specified Sealer/Hardener Concrete Finish in strict accordance with manufacturer's recommended procedures for each application as specified herein.
 - 5. Comply with recommendations of product manufacturer for drying time between succeeding coats.
 - 6. Recoat sealed floors where there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat free of other defects due to insufficient sealing or sheen. Apply additional Ashford Formula if required by Sealer/Hardener Concrete Finish Manufacturer or Owner's Representative.
 - 7. Remove defective floor areas visible and unacceptable to Sealer/Hardener Manufacturer or Owner's Representative in accordance with Sealer/Hardener Concrete Finish as specified herein.
 - 8. Make edges of Sealer/Hardener Concrete Finish adjoining other materials clean and sharp.

9. Achieve water repellent surface, hardening, dust-proofing, and abrasion resistance of concrete surfaces without changing the natural appearance of the concrete, except for the sheen.
10. After spiff coat has been applied, burnish with High speed propane burnisher capable of a minimum of 2700 rpm equipped with a black stripping pad, followed by a purple pad and a blue burnishing pad or a hog's hair pad to develop sheen.

3.3 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation of Surface Flatness for Exposed Concrete Floors: 1/8 inch (3 mm) in 10 feet (3 m).

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Manufacturer's representative must be available to provide technical assistance and guidance for surface preparation and application of Sealer/Hardener Concrete Finish.
- B. Sealer/Hardener Concrete Finish shall be inspected and acceptable to the Owner's Representative or the Manufacturer of Sealer/Hardener Concrete Finish. Any area that is found unacceptable shall be repaired by the Certified Applicator as deemed necessary.
- C. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- D. Acceptance:
 1. Areas requiring corrective Work will be identified by Owners Representative.
 2. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work.
 3. Remeasure corrected areas by procedure as specified in TOLERANCES Article.

3.5 WORKMANSHIP AND CLEANING

- A. The premises shall be kept clean and free of debris at all times.
- B. Touch-up and restore finish where damaged.
- C. Remove spilled, splashed or splattered finish material from all surfaces, as required.
- D. Do not mar surface finish or item being cleaned. Make necessary repairs to damaged surfaces caused by cleaning operation or installation of Sealer/Hardener Concrete Finish.
- E. Remove debris from Jobsite. Dispose of materials in separate, closed, sealed containers in accordance with local regulations

3.6 PROTECTION

- A. Protect and Prohibit traffic on Sealer/Hardener Concrete Finished Work according to manufacturer's instructions and recommendations.
- B. Barricade areas to protect Ashford Formula spiff coat until properly cured for traffic according to manufacturer's instructions and recommendations.
- C. Refer to Manufacturer for materials used to cover and protect the flooring surfaces. Do not apply any Tape to the floor as it will etch concrete surfaces.

3.7 SCHEDULES

- A. Sealer/Hardener (SF-1): Ashford Formula; penetrating Sealer/Hardener Concrete Finish, to be placed on all interior concrete floor surfaces.

END OF SECTION 03 35 00

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.
3. Mortar and grout.
4. Masonry-joint reinforcement.
5. Masonry Cleaning
6. Penetrating Water Repellent

1.2 DEFINITIONS

- A. CMU: Concrete masonry units.
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product. For masonry units, include material test reports substantiating compliance with requirements.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. 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 are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 - 2. Density Classification: Normal weight.
 - 3. Color: standard Grey to match adjacent buildings, Verify in Field
 - 4. Finish: Exterior Face smooth molded CMU with tight dense finish, no exposed aggregate, and no surface voids or bug holes.
- C. Concrete Building Brick: ASTM C 55.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi (17.3 MPa).
 - 2. Density Classification: Normal weight.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capital Materials Corporation.
 - b. Lafarge North America Inc.
 - c. Lehigh Cement Company.
 - d. National Cement Company, Inc.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- F. Aggregate for Grout: ASTM C 404.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- H. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-

mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
5. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
6. Provide in lengths of not less than 10 feet (3 m).

2.5 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion and Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

2.6 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.

1. Basis of Design: Sure Klean 600 New Masonry Cleaner as produced by Prosoco.

2.7 PENETRATING WATER REPELLENTS

- A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, ultraviolet resistant, silane and siloxane blend with 400 g/L or less of VOCs.
 1. Basis of Design: Series 662 Prime-A-Pell Plus modified Silane/Siloxane with diffused Quartz Carbide as produced by ChemProbe Masonry Coatings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
 4. For conspicuous vertical lines, such as external corners, door jambs, and reveals, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m) maximum.
 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- D. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation wall.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners by using prefabricated L-shaped units.

3.6 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.7 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.8 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.9 PENETRATING WATER REPELLENT INSTALLATION

A. EXAMINATION

- 1. Verify existing conditions before starting work.
- 2. Verify joint sealants are installed and cured.
- 3. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

B. PREPARATION

- 1. Protection of Adjacent Work:
 - a. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - b. Protect adjacent surfaces not intended to receive water repellent.
- 2. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- 3. Do not start work until masonry mortar substrate is cured a minimum of 30 days.
- 4. Remove loose particles and foreign matter.
- 5. Remove oil and foreign substances with specified cleaner or as recommended by water repellent manufacturer.
- 6. Scrub and rinse surfaces with water and let dry.
- 7. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

C. APPLICATION

- 1. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- 2. Apply at rate recommended by manufacturer, continuously over entire surface.
- 3. Apply two coats, or as recommended by the manufacturer for best results.

4. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.
5. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.
6. Comply with manufacturer's written cleaning instructions.

END OF SECTION 04 22 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural shapes.
2. Channels and angles.
3. Hollow structural sections.
4. Structural pipe.
5. Bolts, connectors, and anchors.
6. Grout.

1.2 UNIT PRICES

A. Structural Steel Framing:

1. Basis of Measurement: By the ton.
2. Basis of Payment: Includes structural members fabricated, installed, and anchored.

1.3 SUBMITTALS

A. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, attachments and bolts.
2. Connections.
3. Indicate welded connections with AWS A2.4 welding symbols, and indicate net weld lengths.

B. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 QUALITY ASSURANCE

A. Perform Work according to following:

1. Structural Steel: AISC 360.

2. High-Strength Bolted Connections: RCSC - Specification for Structural Joints Using ASTM A325 (A325M) or ASTM A490 (A490M) Bolts.

B. Fabricator:

1. Company specializing in fabricating products specified in this Section with minimum three years' experience with following current AISC Certification:
 - a. Standard Steel Building Structures (STD).
 - b. Conventional Steel Building Structures (SBD).

C. Erector:

1. Company specializing in performing Work of this Section with minimum three years' experience with following current AISC Certification:
 - a. Certified Steel Erector (CSE).
 - b. Advanced Certified Steel Erector (ACSE).

- D. Welders and Welding Procedures: AWS D1.1 (D1.1M) qualified within previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

- A. Structural W Shapes: ASTM A992 (A992M).
- B. Structural T Shapes: Cut from structural W shapes.
- C. Channels and Angles: ASTM A36 (A36M).

- D. Round, Hollow Structural Sections: ASTM A500 (A500M), Grade B.
- E. Rectangular, Hollow Structural Sections: ASTM A500 (A500M), Grade B.
- F. Structural Pipe: ASTM A53 (A53M), Grade B.
- G. Structural Plates and Bars: ASTM A36 (A36M).

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Bolts: Heavy-hex, structural type.
 - 1. ASTM A325 (A325M); Type 1, hot-dip galvanized.
- B. Nuts: ASTM A563 (A563M); heavy-hex type.
 - 1. Finish: Hot-dip galvanized.
- C. Washers:
 - 1. ASTM F436 (F436M).
 - 2. Type 1
 - 3. Finish: Hot-dip galvanized.
- D. Anchor Rods:
 - 1. ASTM F1554; Grade 55
 - 2. Shape: Hooked.
 - 3. Plate Washers: ASTM A36 (A36M).
- E. Threaded Rods:
 - 1. ASTM A36 (A36M).
 - 2. Finish: Hot-dip galvanized.

2.3 WELDING MATERIALS

- A. Welding Materials:
 - 1. AWS D1.1 (D1.1M).
 - 2. Type required for materials being welded.

2.4 FINISHES

- A. Interior Steel: Factory applied SSPC-Paint 20 Organic Zinc Rich Epoxy Primer, See Section 099123 "Painting" for topcoat.
- B. Exterior Steel: Galvanizing: ASTM A123 (A123M); hot-dip galvanize after fabrication.

C. Galvanizing for Bolts, Connectors, and Anchors:

1. Hot-Dip Galvanizing:
 - a. Bolts, Nuts, and Washers: ASTM F2329.
 - b. Connectors and Anchors: ASTM A153 (A153M).
2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible.

1. Space shear stud connectors at 24 inches o.c., unless indicated otherwise on Drawings.
2. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
3. Fabricate connections for bolt, nut, and washer connectors.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to be shop primed by power tool cleaning, SSPC-SP 3, or Blast cleaning SSPC-SP10.

G. Shop Priming: (For steel to be primed) Apply one coat of Organic, Zinc Rich Epoxy primer to structural steel to provide a continuous, dry paint film thickness of not less than 4-6 mils (0.1-0.15 mm).

2.6 ACCESSORIES

A. Grout:

1. Non-shrink type; premixed compound consisting of nonmetallic aggregate, cement, water-reducing, and plasticizing additives.
 2. Capable of developing minimum compressive strength of 14000 psi at 28 days.
- B. Touchup Primer for Galvanized Surfaces:
1. Comply with ASTM A780 (A780M).
- C. Touchup Primer for Primed Surfaces:
1. SSPC-Paint 20 Organic Zinc Rich Epoxy Primer.

2.7 SOURCE QUALITY CONTROL

- A. Testing: Test bolted and welded connections as specified in PART 3 for field quality control tests.
- B. Certificate of Compliance: When fabricator is approved by authorities 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 EXAMINATION

- A. Verify that bearing surfaces are at correct elevation.
- B. Verify that anchor rods are set in correct locations and arrangements, with correct exposure for steel attachment.

3.2 PREPARATION

- A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

- A. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field-weld components and shear connectors as indicated on Drawings.
- C. Field-connect members with threaded fasteners; torque to required resistance and snug-tighten for bearing-type connections.
- D. Do not field-cut or alter structural members without approval of Architect/Engineer.

- E. After erection, touch up welds and abrasions to match shop finishes.

3.4 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story, noncumulative.
- B. Maximum Offset from Alignment: 1/4 inch .

3.5 FIELD QUALITY CONTROL

- A. Bolted Connections: Inspect according to AISC 303.
 - 1. Visually inspect all bolted connections.
 - 2. Direct Tension Indicators: Comply with requirements of ASTM F959 (F959M), and verify that gaps are less than gaps specified in Table 2.
- B. Welding: Inspect welds according to AWS D1.1 (D1.1M).
 - 1. Use certified welders, and conduct inspections and tests as required. Record types and locations of defects found in Work. Record work required and performed to correct deficiencies.
 - 2. Visually inspect all welds.
- C. Correct defective bolted connections and welds.

3.6 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, bolts, washers, nuts, rust spots, and abraded surfaces of prime-painted structural steel, accessories and bearing plates.
 - 1. Clean and prepare surfaces by hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
 - 3. See Section 099123 Painting for final finish coat for exposed structural steel
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that joists and accessories are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 05 12 00

SECTION 052100 - STEEL JOISTS

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. Open-web steel joists with bridging, anchors, extended ends, extensions, and special seats.
 - a. Steel Joist Types include the following:
 - i. K-series steel joists
 - ii. K-Series steel joist substitutes
 2. Shop priming and painting of steel joists.
 3. Field touch-up paint for painted joists after erection
 4. Loose bearing plates and anchor bolts for placement

1.3 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
 1. Roof Joists: Vertical deflection as indicated on drawings.
- C. Engineering Responsibility: Engage a joist manufacturer who utilizes a qualified professional engineer to prepare design calculations, shop drawings, and other structural data for steel joists.

1.5 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings: Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and

connection locations and details; and attachments to other construction.

1. Indicate locations and details of bearing plates to be embedded in other construction.
 2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- C. Welding certificates.
- D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.
- E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.
- F. Qualification Data: For manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications".
1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "Specifications", that are applicable to types of joists indicated.
- C. Welding Standards: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code--Steel".

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- B. Steel Bearing Plates: ASTM A 36 /A 36M.

- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

- 1. Finish: Plain, unless otherwise indicated.

- D. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

- 1. Finish: Plain, unless otherwise indicated.

- E. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

- A. Shop Primer: **SSPC-Paint 20 Organic Zinc Rich Epoxy Primer Type II** complying with performance requirements in SSPC-Paint 20.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, under-slung ends, and parallel top chord.

- 1. Joist Type: K-series steel joists.

- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

- D. Provide holes in chord members for connecting and securing other construction to joists.

- E. Do not camber joists.

- F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A 123/A 123M.

- C. Supply miscellaneous accessories, including splice plates and bolts required by the joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by power tool cleaning, SSPC-SP 3, or Blast cleaning SSPC-SP10.
- B. Apply one coat of Organic Zinc Rich Epoxy primer to joists and joist accessories to be primed to provide a continuous, dry paint film thickness of not less than 4-6 mils (0.1-0.15 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of joists.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's recommendations, and the requirements of this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and bridging, connections, and anchors to ensure joists are stabilized during construction.
 - 4. Extend bottom chords at column lines and weld to columns.
 - 5. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel framework and steel bearing plates. Coordinate welding sequence and procedure with placing of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent special testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspection and prepare test and inspection reports.

- B. Field welds will be visually inspected according to AWS D1.1/D1.1M.
- C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:
 - 1. Radiographic Testing: ASTM E 94.
 - 2. Magnetic Particle Inspection: ASTM E 709.
 - 3. Ultrasonic Testing: ASTM E 164.
 - 4. Liquid Penetrant Inspection: ASTM E 165.
- D. Bolted connections will be visually inspected.
- E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, bolts, washers, nuts, rust spots, and abraded surfaces of prime-painted joists, accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by hand tool cleaning, SSPC-SP 2, or power tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
 - 3. See Section 099123 Painting for final finish coat for structural steel
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that joists and accessories are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 00

STEEL DECK

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. Section includes:
 - a. Steel roof deck.

1.3 REFERENCE STANDARDS

- A. American Welding Society
 - a. AWS D1.1/D1.1M - Structural Welding Code - Steel.
- B. ASTM International:
 - a. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - b. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - c. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - d. ASTM A780/780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - e. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- C. Steel Deck Institute:
 - a. SDI 31 - Design Manual for Composite Decks, Form Decks and Roof Decks.
- D. UL:
 - a. UL - Fire-Resistance-Rated Systems and Products Directory.

1.4 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding Certificates.
- E. Product Test Reports: Based on evaluation of comprehensive tests preformed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.7 COORDINATION

- A. Coordinate layout and installation of ducts and other components specified on mechanical drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Buildings Co.
 - 2. ASC Pacific Inc.
 - 3. Bowman Metal Deck Armco, Inc.
 - 4. Consolidated Systems, Inc.
 - 5. Epic Metals Corp.
 - 6. Marlyn Steel Products, Inc.
 - 7. Robertson A United Dominion Co.
 - 8. Roof Deck, Inc.
 - 9. United Steel Deck, Inc.
 - 10. Verco Manufacturing Co.
 - 11. Vulcraft Div. of Nucor Corp.
 - 12. Walker Div. of Butler Manufacturing Co.
 - 13. Wheeling Corrugating Co., Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels to comply with SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 minimum, G 90 zinc coating, with an organic zinc rich epoxy primer factory applied to the exposed underside of the decking (SSPC Paint-20 Type II).
 - 2. Deck Profile: As indicated.
 - 3. Profile Depth: As indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Triple span, unless framing requires otherwise.
 - 6. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.
- C. Side Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 (4.8 mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application
- F. End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.53 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- H. Recessed Sump Pans: Single-piece steel sheet, 0.0747-inch (1.9-mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Repair Paint: SSPC-Paint 20 Zinc rich epoxy primer, with a minimum dry film thickness of 4-6 mils.
- J. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359-inch- (0.91-mm-) thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
- C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
- D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

- F. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (305 mm) apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent special inspection and testing agency to perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Testing agency will report test results promptly and in writing to the Owner, Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Paint Repairs: Prepare and repair damaged primer coatings on both surfaces with SSPC Paint 20 repair paint according to ASTM A780 and the manufacturer's instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel stair frame of structural sections, with open risers.
2. Open grate stair treads and landings.
3. Integral Guardrail.
4. Handrail

B. Related Requirements:

1. Section 055300 - Metal Gratings

1.2 SUBMITTALS

A. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

B. Welders' Certificates: Certify welders and welding procedures employed on the Work, verifying AWS qualification within previous 12 months.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Qualifications Statements:

1. Submit qualifications for fabricator, erector, and licensed professional.
2. Submit manufacturer's approval of fabricator and erector.

1.3 QUALITY ASSURANCE

A. Perform railing work according to ASTM E985.

B. Finish joints according to NOMMA Guideline 1.

1.4 QUALIFICATIONS

- A. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months for employed weld types.
- B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' experience.
- C. Erector: Company specializing in performing Work of this Section with minimum three years' experience.

1.5 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Fabricate stair assembly to support uniform live load of 60 lb./sq. ft. and concentrated load of 250 lb./sq. ft. with deflection of stringer or landing framing not to exceed 1/240 of span.
- B. Railing assembly, wall rails, and attachments to resist lateral force of 250 lb. at any point without damage or permanent set.
- C. Fabricate stair assembly to NAAMM AMP 510, industrial class.

2.2 METAL STAIRS

- 1. Furnish materials according to applicable standards.

2.3 MATERIALS

- A. Structural W-Shapes: ASTM A992 (A992M).
- B. Structural T-Shapes: Cut from structural W-shapes.
- C. Channels and Angles: ASTM A36 (A36M).
- D. Round Hollow Structural Sections: ASTM A500 (A500M), Grade B.
- E. Square and Rectangular Hollow Structural Sections: ASTM A500 (A500M), Grade B.
- F. Structural Pipe: ASTM A53 (A53M), Grade B.
- G. Tubing: ASTM A513 (A513M), Type 5, minimum 50 ksi yield strength.

- H. Structural Plates: ASTM A53 (A53M).
- I. Bolts: ASTM A325 (A325M), Type 1.
 - 1. Finish: Hot-dip galvanized.
- J. Nuts: ASTM A563 (A563M), heavy-hex type.
 - 1. Finish: Hot-dip galvanized.
- K. Washers:
 - 1. For ASTM A325 (A325M) Bolts: ASTM F436 (F436M); Type 1.
 - a. Finish: Hot-dip galvanized
- L. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- M. Welding Materials: AWS D1.1 (D1.1M); type required for materials being welded.
- N. Touchup Primer: as applicable for hot-dipped Galvanized finish.
- O. Gratings: See Section 055300 "Metal Gratings"
- P. Stair Treads: See Section 055300 "Metal Gratings"

2.4 FABRICATION

- A. Fit and shop-assemble components in largest practical sections, for delivery to Site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Continuously seal joined pieces by continuous welds.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

- H. Accurately form components required for anchorage of stairs landings and railings to each other and to building structure.
- I. Open Grating Stairs and Landings:
 - 1. Fabricate treads 1 1/2 inch (38mm) thick according to NAAMM MBG 531, of Welded steel bars bolted to supports; galvanized finish.
 - 2. Form hollow stringers with rolled-steel channels; galvanized finish.
 - 3. Form landings 1 1/2 inch (38 mm) thick according to NAAMM MBG 531, same as treads; galvanized finish. Reinforce underside with angles as needed to attain design load requirements.
 - 4. Form Guardrails with 2 inch (50-mm)- diameter steel sections bolted to stringers; galvanized finish.
 - 5. Form Handrails with 1 1/2 inch (38-mm)- diameter steel sections welded to guardrails; galvanized finish.

2.5 FINISHES

- A. All exterior metal stair components shall be hot-dipped galvanized after fabrication.
- B. Galvanizing: ASTM A123 (A123M); hot-dip galvanize.
- C. Galvanizing for Fasteners, Connectors, and Anchors:
 - 1. Hot-Dip Galvanizing: ASTM A153 (A153M).
 - 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Verify that concealed blocking and reinforcement is installed and correctly located to receive wall-mounted handrails.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where Site welding is required.
- B. Supply items required to be cast into concrete with setting templates.

3.3 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Install anchors, plates, angles and struts required for connecting stairs to structure.

- C. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.
- D. Field-weld components indicated on Drawings. Perform field welding according to AWS D1.1 (D1.1M).
- E. Field-bolt and -weld to match shop bolting and welding. Conceal bolts and screws whenever possible.
- F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- G. Obtain approval of Architect/Engineer prior to Site cutting or creating adjustments not scheduled.
- H. After erection, prime welds, abrasions, and surfaces not galvanized, except surfaces to be in contact with concrete.

3.4 TOLERANCES

- A. Maximum Variation from Plumb: 0.25 inch per story, noncumulative.
- B. Maximum Offset from Alignment: 0.25 inch.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Inspect welds according to AWS D1.1 (D1.1M).

END OF SECTION 05 51 00

SECTION 05 53 00
METAL GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flat surface floor and stair treads.
 - 2. Perimeter closure.

1.2 SUBMITTALS

- A. Product Data: Submit span and deflection tables.
- B. Shop Drawings: Indicate details of gratings, plates, component supports, anchorages, openings, perimeter construction details, and tolerances. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Welders' Certificates: Certify welders and welding procedures employed on the Work, verifying AWS qualification within previous 12 months.
- E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for gratings and plates.

1.3 QUALITY ASSURANCE

- A. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months for employed weld types.
- B. Licensed Professional: Professional engineer experienced in design of specified Work and licensed at Project location.

1.4 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Conform to applicable code for applicable loads.

2.2 MATERIALS

- A. Formed Steel: ASTM A1011 (A1011M).
- B. Touchup Primer for Galvanized Surfaces

2.3 FABRICATION

- A. Grating Type: NAAMM MBG 534-19

2.4 FINISHES

- A. Galvanizing: ASTM A123 (A123M); hot-dip galvanize after fabrication.
- B. Surface: Serrate

2.5 ACCESSORIES

- A. Fasteners and Saddle Clips, Flange Blocks, and J-hooks: Galvanized steel.
- B. Perimeter Closure: Same material as grating.
- C. Edge Banding: full depth at edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes and dimensional tolerances are acceptable.
- B. Verify that supports and anchors are correctly positioned.

3.2 INSTALLATION

- A. Place frames in correct position, plumb and level.
- B. Mechanically cut galvanized finish surfaces. Do not flame cut.

- C. Anchor by bolting through saddle clips.
- D. Set perimeter closure flush with top of grating and surrounding construction.
- E. Secure to prevent movement.

3.3 TOLERANCES

- A. Conform to NAAMM MBG 534.

3.4 CLEANING

- A. Clean welds and damaged coatings and apply two coats of touchup primer.

END OF SECTION 05 53 00

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Roofing cant strips.
- D. Preservative treated wood materials.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. AWWA U1 - Use Category System: User Specification for Treated Wood 2018.
- D. PS 20 - American Softwood Lumber Standard 2020.
- E. SPIB (GR) - Grading Rules 2014.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.04 WARRANTY

- A. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.

2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 1. Lumber: S4S, No.2 or Standard Grade.
 2. Boards: Standard or No.3.

2.03 ACCESSORIES

- A. Fasteners and Anchors:
 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 2. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.04 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.
- B. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWP A U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.
 - e. Treat lumber less than 18 inches above grade.
 - f. Treat lumber in other locations as indicated.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Install sill gasket under sill plate bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 CLEANING

- A. Waste Disposal:
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 53

SECTION 06 80 00

COMPOSITE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Glass-fiber-reinforced, resin fabrications, as scheduled at the end of this Section.
2. Reinforcing members, fasteners, anchors, and like, for the completion of this Work.
3. Fiberglass Grating & structural members.

B. Related Sections:

1. Section 033000 – Cast in Place Concrete: Embedment of structural members

1.2 SCOPE OF WORK

- A. The Contractor shall furnish, fabricate (where necessary), and install all fiberglass reinforced plastic (FRP) items, with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and in accordance with the requirements of the Contract Documents.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D 635 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
2. ASTM E 84 Surface Burning Characteristics of Building Materials

B. National Sanitation Foundation (NSF):

1. NSF/ANSI STANDARD 61

C. Underwriters Laboratories Inc.:

1. UL - Fire Resistance Directory.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.

- C. Delegated Design: Submit signed and sealed Shop Drawings with design calculations and Verified Load Capacity of Grating, structural members, and accessories.
- D. Shop Drawings: Submit shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section. Shop drawings shall clearly show material sizes, types, styles, part or catalog numbers, complete details for the fabrication and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
- E. Samples: Submit sample pieces of each item specified herein for acceptance by the Owner's Representative as to quality and color.
- F. Qualification Statements:
 - 1. Submit qualifications for manufacturer, installer, and licensed professional.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum of ten years' experience in the design and manufacture of similar products and systems.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.
- C. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Maryland.
- D. Manufacturer shall provide proof, via independent testing, that materials proposed as a solution do not contain heavy metals in amounts greater than that allowed by current EPA requirements.

1.6 WARRANTY:

- A. Manufacturer shall offer a 3-year limited warranty on all FRP products against defects in materials and workmanship.

1.7 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.8 PRODUCT DELIVERY AND STORAGE

- A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
- B. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, deformation, and other types of damage. Adhesives, resins and their catalysts are to be stored in dry indoor conditions between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 - PRODUCTS

2.1 GLASS FIBER AND RESIN FABRICATIONS

- A. Manufacturers:
 - 1. AMD Inc.
 - 2. Fibergrate Composite Structures Inc.
 - 3. Strongwell
 - 4. Substitutions: Section 016000 - Product Requirements.

2.2 GENERAL

- A. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
- B. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.
- C. Resin shall be Vinyl Ester used to produce NSF Standard 61 certified grating with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.
- D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
- E. All fire-retardant molded grating products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall not burn past the 25 mm reference mark and will be classified HB per ASTM D635.
- F. All grating products shall be certified to NSF/ANSI Standard 61
- G. All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

2.3 MOLDED FRP GRATING

- A. Manufacture: Grating shall be of a one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane. Grating shall have a square mesh pattern providing bidirectional strength. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 1/8" below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces. Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements of the contract.
- B. After molding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

- C. Non-slip surface: Grating shall be manufactured with an integrally applied grit to the top surface of each bar providing maximum slip resistance.
- D. Grating bar intersections are to be filleted to a minimum radius of 1/16" to eliminate local stress concentrations and the possibility of resin cracking at these locations.
- E. Fire rating: Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E 84. Data performed only on the resin shall not be acceptable.
- F. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating product corrosion resistance and shall not be accepted.
- G. Color: To be selected by Owner's Representative from the manufacturer's standard line of available colors for resin selected.
- H. Depth: 1 1/2" with a tolerance of plus or minus 1/16".
- I. Mesh Configuration: 1 1/2" x 1 1/2" with a tolerance of plus or minus 1/16" mesh centerline to centerline. (or as required to meet desired loading requirements)
- J. Load/Deflection: Grating design loads shall be less than manufacturers published maximum recommended loads. Maximum recommended loads shall be determined by acoustic emission testing. Grating shall be designed for a uniform load of 100 psf or concentrated load of 300 lb. Deflection is not to exceed 0.375" or $L/D = 120$, whichever is less.
- K. The manufacturer shall certify that the stiffness of all panels manufactured are never more than 2.5% below the published load-deflection values.

2.4 GRATING FABRICATION

- A. Measurements: Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.
- B. Layout: Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.
- C. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.
- D. Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

2.5 PULLTRUDED STRUCTURAL MEMBERS

- A. All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.
- B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
- C. Resins shall be fire retardant vinyl ester used to produce NSF Standard 61 certified shapes, with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.
- D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
- E. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with:
 - 1. Integral UV inhibitors in the resin
 - 2. A synthetic surfacing veil to produce a resin rich surface.
- F. All *fire retardant* FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test.
- G. All shapes products shall be certified to NSF/ANSI Standard 61.
- H. Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	2.5×10^6 (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)
Flexural Modulus	D-790	1.8×10^6 (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	2.8×10^6 (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	4.5×10^5 (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	4.4×10^{-6} (8.0×10^{-6})	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

2.6 FABRICATION

- A. Measurements: Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.
- B. Sealing: All shop fabricated cuts or drilling shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts or drilling shall be coated similarly by the contractor in accordance with the manufacturer's instructions.
- C. Hardware: Type 316 stainless steel bolts shall be provided.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Requirements for installation examination.
- B. Verify substrate openings.
- C. Verify substrates are ready to receive Work and dimensions are as indicated on approved Shop Drawings.

3.2 INSTALLATION

- A. Contractor shall install gratings in accordance with manufacturer's assembly drawings. Fasten grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.
- B. Attach FRP units securely to supports.
- C. Joints: Only where shown on approved Shop Drawings.
- D. Ensure that completed installations are free of warp, wave, misalignment, and damaged components.

3.3 ERECTION TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation from Indicated Position: 1/8 in (3 mm).
- C. Maximum Offset from Alignment Adjacent Components: 1/8 in (3 mm).

3.4 CLEANING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean components of foreign material without damaging finished surface.

END OF SECTION 06 80 00

SECTION 07 41 13

METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural lapped seam metal roofing.

B. Related Requirements:

1. Section 054000 - Cold-Formed Metal Framing: Structural framing supporting metal roofing.
2. Section 076200 - Sheet Metal Flashing and Trim: Sheet metal, flashing, and trim associated with roofing and waterproofing membranes.

1.2 REFERENCE STANDARDS

A. American Architectural Manufacturers Association:

1. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
2. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society of Civil Engineers:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
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.

D. Federal Specification Unit:

1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

E. National Roofing Contractors Association:

1. NRCA - Roofing and Waterproofing Manual.

F. Sheet Metal and Air Conditioning Contractors' National Association:

1. SMACNA - Architectural Sheet Metal Manual.

G. UL:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.

1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with Work of Section 054000 - Cold-Formed Metal Framing for connecting structural supports to building structural frame.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit fabricator information on metal types, finishes, and characteristics.
 2. Submit color charts for initial finish selection.
- C. Shop Drawings:
 1. Indicate metal roofing panel profiles, jointing patterns, jointing details, fastening methods, flashings, terminations, and installation details.
- D. Samples:
 1. Submit physical samples 4 inch by 4 inch in size, illustrating metal finish color, of the initial selections made from the color chart for final selection.
- E. Fabricator's Certificate: Certify that products meet or exceed specified requirements.

- F. Fabricator Instructions: Submit detailed instructions on installation requirements, including special procedures for roofing penetrations, flashings, and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Calculate structural properties of framing members according to AISI NASPEC.
- B. Perform Work according to SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.
- C. Perform Work according to Worcester County Public Works standards.
- D. Single Source: Provide metal roof panel assembly and accessories from a single manufacturer

1.6 QUALIFICATIONS

- A. Fabricator: Company specializing in fabricating products specified in this Section with minimum five years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by fabricator.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to fabricator instructions.
 - 2. Stack material to provide ventilation and to prevent twisting, bending, and abrasion.
 - 3. Slope metal sheets to ensure drainage.
- D. Protection:
 - 1. Prevent contact with materials causing discoloration or staining.
 - 2. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 3. Provide additional protection according to fabricator instructions.

1.8 EXISTING CONDITIONS

- A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish 20-year fabricator's warranty for sheet metal roofing against structural failure, corrosion, and water penetration.
- C. Furnish 25-year manufacturer's warranty for metal finish against fading, chipping, chalking, and blistering.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer subject to compliance with these specifications: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.
- B. Other Manufacturers:
 1. ATAS International, Inc.
 2. Drexel Metals.
 3. Fabral.
 4. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 5. Substitutions: As specified in Section 016000 - Product Requirements

2.2 PERFORMANCE AND DESIGN CRITERIA

- A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.
- C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:
 1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 2. Wind Uplift Resistance: Comply with UL 580 for wind-uplift class UL-60.
 3. Live Loads: As indicated on Drawings
 4. Dead Loads: As indicated on Drawings or actual weight of materials incorporated into work, whichever is greater.

5. Snow Loads: As indicated on drawings.
6. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.
7. Seismic Performance: As indicated on Drawings

2.3 METAL ROOF PANELS

- A. Tapered-Rib-Profile, Exposed Fastener Metal Roof Panels: Structural metal roof panel consisting of formed metal sheet with trapezoidal ribs, installed by lapping edges of adjacent panels.
 1. Basis of Design Subject to compliance with these specifications: MBCI, 7.2 Panel
 2. Coverage Width: 36 inches (914 mm).
 3. Continuous Rib Spacing: 7.2 inches (183 mm) on center.
 4. Rib Height: 1-1/2 inch (38.1 mm).
 5. Nominal Coated Thickness: 0.028 inch/24 gage 0.71 mm)
 6. Panel Surface: Smooth.
 7. Material: Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.
 8. Exterior Finish: Fluoropolymer two-coat system; Basis of Design MBCI Signature 300
 9. Color: As selected by Architect from manufacturer's standard colors.

2.4 METAL ROOF PANEL ACCESSORIES

- A. General: Provide complete metal roof panel assembly incorporating ridge, eave, rake, valley, and parapet trims, copings, fascias, gutters and downspouts, and miscellaneous flashings, in manufacturer's standard profiles. Provide required fasteners, closure strips, support plates, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.
- C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by roof panel manufacturer.
 1. Exposed Fasteners: Long life fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.
- D. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:
 1. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.
 2. Concealed Joint Sealants: Non-curing butyl, AAMA 809.2.
 3. Exposed Joint Sealants: Urethane, single component, ASTM C 920.
- E. Structural Supports:
 1. Description:
 - a. Metal Framing: As specified in Section 054000 - Cold-Formed Metal Framing.

2.5 MATERIALS

A. Sheet Metal:

1. Description: Prefinished galvanized steel, coil coated.
2. Comply with ASTM A755/A755M.
 - a. Base Metal:
 - 1) Comply with ASTM A653/A653M.
 - 2) Quality: Structural.
 - 3) Grade: 50 (340).
 - 4) Zinc Coating: Class G90 (Z275).
 - b. Exposed Finish Coating: Minimum two coats fluoropolymer with minimum 70 percent polyvinylidene fluoride (PVDF) resin.
 - c. Unexposed Finish Coating: Fabricator's standard.

2.6 FABRICATION

- A. Form section shapes as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Panel Lengths: Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.
- C. Fasciae, Trim, Flashings, and Other Metal Components:
 1. Same material as metal roof panels.
 2. Provide exposed metal surfaces with same finish as exposed face of metal roof panels.
- D. Cleats:
 1. Material: Same as sheet.
 2. Interlock with sheet.
- E. Starter Strips:
 1. Description: Continuous, to interlock with sheet.
 2. Material: Same as sheet.
- F. Form pieces in longest practical lengths.
- G. Hems and Seams:
 1. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
 2. Hem exposed edges on underside 1/2 inch (13 mm).
 3. At moving joints, use sealed and lapped bayonet-type or interlocking hooked seams.
- H. Corners:

1. One piece.
2. Minimum Leg Length: 18 inches (450 mm).
3. Miter and seam corners and seal with sealant.

I. Flashings:

1. Allow toe to extend 2 inches (50 mm) over roofing.
2. Return and brake edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Structural Framing Substrate:
 1. Verify that primary and secondary framing members are installed and fastened, properly aligned, and sloped.
 2. Verify that damaged shop coatings are repaired with touchup paint.
- C. Verify that roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips are located properly.
- D. Verify that roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mils (0.4 mm).

3.3 INSTALLATION

- A. Structural Supports:
 1. As indicated on Drawings.
 2. Align supports with top surface in plane, uniformly sloped to eaves.
 3. Spacing:
 - a. Maximum 2 feet (610 mm) o.c.
 - b. Provide support at roof panel end laps.
 4. Secure supports to building structural frame with mechanical fasteners.

B. Lapped Seam Metal Roofing:

1. Install furring configured to continuously support roof panel side laps and receive fasteners.
2. Panels:
 - a. Install roofing panels with long dimension perpendicular to eaves.
 - b. Begin installation at eaves.
 - c. Weather-lap ends minimum 6 inches (150 mm).
3. Align transverse-lapped joints of roofing sheets.
4. Termination:
 - a. Terminate roofing panels with sheet metal trim and flashing.
 - b. Close and conceal openings between roofing panels, panel seams, and roof substrate.
5. Seal metal joints watertight.

C. Flashing:

1. Reglets:
 - a. As specified in Section 042000 - Unit Masonry.
 - b. Insert flashings into reglets to form tight fit.
 - c. Secure in place with lead wedges at maximum 6 inches (150 mm) o.c.
 - d. Seal flashings into reglets with sealant.
2. Fascia:
 - a. Place eave edge metal flashings tight to fascia.
 - b. Weather-lap joints 2 inches (50 mm) and seal with plastic cement.
 - c. Secure flange to substrate.
3. Fasteners:
 - a. Secure flashings in place using concealed fasteners.
4. Secure flashing exposed edges with continuous cleats.
5. Apply plastic cement compound between metal flashings and felt flashings.
6. Fit flashings tight in place, making corners square, surfaces true and straight in planes, and lines accurate to profiles.
7. Seal metal joints watertight.

3.4 PROTECTION

- A. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.

- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 07 41 13

SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
 - 2. Warranty Period: Minimum 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- a. Carlisle SynTec Incorporated: 80-mil Sure Weld
 - b. Firestone Building Products Company: UltraPly 80-mil
 - c. GAF Materials Corporation EverGuard Extreme 80-mil
 - d. Mule-Hide Products Co., Inc. 80-mil
- B. Source Limitations: Obtain components including roof insulation, fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
 - 1. Corner Uplift Pressure: 113 lbf/sq. ft.
 - 2. Perimeter Uplift Pressure: 83 lbf/sq. ft.
 - 3. Field-of-Roof Uplift Pressure: 63 lbf/sq. ft.
- D. Solar Reflectance Index: Not less than 29 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class B: for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
 - 1. Thickness: 80-mil
 - 2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard reinforced TPO sheet flashing, 60 mils thick, minimum, of same color as TPO sheet.
- C. Bonding Adhesive: Manufacturer's standard, water based.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer, for use as noted in 3.3 D.
- E. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class I, Grade 3, felt or glass-fiber mat facer on both major surfaces.
- B. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- B. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick, factory primed.

PART 3 - EXECUTION

3.1 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.2 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Install tapered insulation under area of roofing to conform to slopes indicated.
- C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- D. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.

3.3 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- D. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing per the manufacturer's instructions.
- E. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.

2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- F. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.4 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars when shown on drawings.

3.5 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashing tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg. F (67 deg. C), ambient; 180 deg. F (100 deg. C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Exposed Coil-Coated Finish:
 - 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.
 - 2. Color: As selected by Architect from manufacturer's full range.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; finish as manufactured.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Slip Sheet: Rosin-sized building paper, 3 lb. / 100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.

2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS & ACCESSORIES

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
1. Accessories: Wire-ball downspout strainer.
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.
1. Hanger Style: Strap.
 2. Fabricate from the following materials:
 - a. Aluminum: 0.024 inch (0.61 mm) thick.
- C. Downspout Boots: PVC downspout boot sized for downspout indicated as required to transition to sub-grade drainpipe.

2.7 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: York 304 – Self Adhering Stainless Steel.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.

- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws or not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Install gutter with expansion joints not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Pipe Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042613 "Masonry Veneer."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 62 00

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealant.
 - 2. Urethane joint sealant.
 - 3. Latex joint sealant.
 - 4. Preformed joint sealant.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- 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. Product test reports.
- B. Preconstruction compatibility and adhesion test reports.
- C. Preconstruction field-adhesion test reports.
- D. Field-adhesion test reports.
- E. Warranties.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which 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's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

- 1. Warranty Period: 10 years from date of Substantial Completion. Others

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.2 SILICONE JOINT SEALANTS

- A. Silicone Joint Sealant ASTM C 920.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials - Silicones.
 - d. May National Associates, Inc.
 - e. Pecora Corporation.
 - f. Polymeric Systems, Inc.
 - g. Schnee-Morehead, Inc.
 - h. Sika Corporation; Construction Products Division.
 - i. Tremco Incorporated.
- 2. Type: Single component (S).
- 3. Grade: Nonsag (NS).
- 4. Class: 50
- 5. Uses Related to Exposure: Nontraffic (NT)

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Pacific Polymers International, Inc.
 - d. Pecora Corporation.
 - e. Polymeric Systems, Inc.
 - f. Schnee-Morehead, Inc.
 - g. Sika Corporation; Construction Products Division.
 - h. Tremco Incorporated.
2. Type: Single component (S) or multicomponent (M).
3. Grade: nonsag (NS).
4. Class: 50
5. Uses Related to Exposure: Traffic Grade (TG).

2.4 HYBRID POLYMER JOINT SEALANTS

A. Hybrid Polymer Joint Sealant: Silane Modified Polymer or Modified Silane, ASTM C 920

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Pacific Polymers International, Inc.
 - d. Pecora Corporation.
 - e. Polymeric Systems, Inc.
 - f. Schnee-Morehead, Inc.
 - g. Sika Corporation; Construction Products Division.
 - h. Tremco Incorporated.
2. Type: Single component (S) or multicomponent (M).
3. Grade: nonsag (NS).
4. Class: 50
5. Uses Related to Exposure: Nontraffic (NT).

2.5 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dayton Superior Specialty Chemicals.
 - b. EMSEAL Joint Systems, Ltd.
 - c. Sandell Manufacturing Co.
 - d. Schul International, Inc.
 - e. Willseal USA, LLC.

2.6 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.7 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.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 1. Remove laitance and form-release agents from concrete.
 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.
- 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.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. 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.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. 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.
- E. 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.
- F. 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.

3.3 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Joint Sealant: Preformed foam.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plant-precast architectural concrete units.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between metal panels.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors windows and louvers.
 2. Joint Sealant: Hybrid Polymer Sealant
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 2. Joint Sealant: Traffic Grade Urethane.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of walls and partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors and windows
 2. Joint Sealant: Hybrid Polymer Sealant
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 2. Joint Sealant: Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 16 13

FIBERGLASS 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Fiberglass Reinforced Plastic (FRP) Doors and Fiberglass Resin Transfer Molded Door Frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 4 Section "Unit Masonry" for building anchors into and grouting frames in masonry construction.
 - 2. Division 8 Section "Door Hardware" for door hardware and weatherstripping.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- C. Shop Drawings showing fabrication and installation doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

- A. Reference Standards
 - 1. Door Properties

- a. Standard test method for steady state thermal transmission properties by means of the heat flow meter apparatus.
- b. Successfully completed 1,000,000 cycles test in accordance with:
 - i. AAMA 920-03 – Specification for Operating Cycle Performance of Side-Hinged Exterior Door Systems.
 - ii. ANSI A250.4-2001 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
 - iii. NWWDA TM-7 Test Method to Determine the Physical Endurance of Wood Doors and Associated Hardware Under Accelerated Operating Conditions.

2. Laminate Properties

- a. Door face plate is a minimum of 0.125 inch thick fiberglass reinforced plastic molded into one continuous sheet starting with a 25 mil resin-rich gelcoat layer resin integrally molded with multiple layers of 1.5 oz. sq ft fiberglass mat and one layer of 18 oz per square yard fiberglass woven roving saturated with special resin. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass resin.
- b. Laminated plate by itself evaluated in accordance with Florida Building Code TAS 201 Large Missile Impact Test as per ASTM-1996-05b, Standard Specification for Performance of Exterior Windows, Curtain Wall, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes. The missile (a 2 x 4 with a weight of 9 lbs shot from a cannon at a velocity of 50 ft/sec) did not penetrate the door face plate.
 - i. ASTM D 638 Tensile Strength Properties of Plastic
 - ii. ASTM D 790 Flexural Strength Properties of Plastic
 - iii. ASTM D 2583 Indentation Hardness of Plastics
 - iv. ASTM D 256 Izod Pendulum Impact Resistance
 - v. ASTM D 792 Density/Specific Gravity of Plastics
 - vi. ASTM D 1761 Mechanical Properties of Fasteners
 - vii. ASTM E 84 Surface Burning Characteristics of Materials
 - viii. ASTM G 155 Xenon Light Exposure of Non Metallic Materials
 - ix. ASTM D 635 Method For Rate of Burning
 - x. ASTM D 2843 Smoke Density
 - xi. ASTM D 1929 Self Ignition Temperature Properties
 - xii. SFBC PA 201 Impact Procedures for Large Missile Impact

3. Core properties

- a. ASTM C 177 Thermal Properties of Materials
- b. ASTM D 1622 Density and Specific Gravity
- c. ASTM E 84 Surface Burning Characteristics of Materials
- d. WDMA TM-10 and TM-5 Firestop ASTM E 152 U.L 10(b).
- e. ASTM E90-04- Sound Transmission Loss
- f. ASTM E413-04- Classification for Rating Sound Insulation
- g. ASTM E1332-90- Standard Classification for Determination of Outdoor-Indoor Transmission Class
- h. ASTM E2235-04- Standard Test for Determination of Decay Rates for

Use in Sound Insulation Methods

B. Qualifications

1. All products specified in this section shall be furnished by a single manufacturer specializing in the fabrication of fiberglass doors and frames with no less than five (5) years of successful experience in the fabrication of fiberglass doors and frames of the type required for this project.
2. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.
3. Source limitations: Obtain fiberglass reinforced plastic doors and resin transfer molded fiberglass frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames. This ensures complete uniformity of physical properties and consistency in the resin chemistry tailored for this application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Each door and frame shall be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate shall contain all fasteners necessary for installation as well as complete installation instructions.
 1. Doors shall be stored in the original container on edge, out of inclement weather for protection against the elements.
 2. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to promote air circulation.

1.6 WARRANTY

- A. All fiberglass doors and frames have a lifetime guarantee against failure due to corrosion. Additionally, fiberglass doors and fiberglass frames are guaranteed for ten years against failure due to materials and workmanship, including warp, separation or delamination, and expansion of the core.
- B. Contractor shall warranty all installation procedures and performance for a period of five (5) years against defects due to workmanship or handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Fiberglass Doors and Frames:
 - a. Basis of Design: Corrim Company, www.Corrim.com
 - b. Chempruf, Brownsville, Texas
 - c. Or approved equal per substitution procedures

2.2 MATERIALS

A. Fiberglass Doors

1. Doors shall be made of fiberglass reinforced plastic (FRP) using Class 1 premium resin with no fillers that is specifically tailored to resist chemicals and contaminants typically found in environment for which these specifications are written. Doors shall be 1 ¾ inch thick and of flush construction, having no seams or cracks. For consistency in the resin chemistry tailored for this application and to maintain the same physical properties throughout the structure, all fiberglass components including face plates, stiles and rails and frames must be fabricated by the same manufacturer. Components obtained through various outside sources for plant assembly will not be accepted.
2. Door sizes shown are nominal and shall include standard clearances as follows: 0.125-inch at hinge and lock stiles, 0.125-inch between meeting stiles, 0.125-inch at top rails, 0.125-inch between bottom and threshold.
3. Door Plates shall be 0.125 inch thick minimum, molded in one continuous piece, starting with 25 mil gelcoat of the color specified, integrally molded with multiple layers of 1.5 ounces per square foot fiberglass mat and one layer of 18 ounce per square yard fiberglass woven roving. Each layer shall be individually laminated with resin as mentioned above. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass to resin. Plate alone to withstand Large Missile Impact per FBC TAS 201. Face plates manufactured using the pultrusion process does not allow for a smooth molded gelcoat finish, the use of woven roving for adequate plate thickness, strength and weight, or the appropriate glass to resin ratio and will not meet the quality standards of this project.
4. Stiles and Rails shall be constructed starting from the outside toward the inside, with a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints and disparate materials used to form the one-piece stile and rail.
5. Core material for non-insulated doors shall be Polypropylene plastic honeycomb core with a non-woven polyester veil for unparalleled plate bonding, 180 PSI typical compression range unless otherwise requested.

6. Core material for insulated doors shall be Class A Polyurethane Foam Core with a minimum R-value of R-10
7. Internal Reinforcement shall be manufacturer's standard of sufficient amount to adequately support required hardware and function of same.
8. Finish of door frame shall be identical with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture resulting in a smooth gloss surface that is dense and non-porous. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat results in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.
9. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Fiberglass retainers, which hold the glazing in place, shall be resin transfer molded with a profile that drains away from glazing. The window retainer must match the color and finish of the door plates with 25 mil of resin-rich gelcoat integrally molded in at time of manufacture. Mechanical fasteners shall not be used to attach retainers. Glass, as specified herein, shall be furnished and installed by door and frame manufacturer. In order to maintain uniform appearance, product longevity and the corrosion resistance this application requires, window retainers fabricated from Metal, PVC or Vinyl will not be accepted.

B. Fiberglass Frames

1. Frames (rated and non-rated) shall be fiberglass and manufactured using the resin transfer method creating one solid piece (no voids) with complete uniformity in color and size. Beginning with a minimum 25 mil gelcoat layer molded in and a minimum of two layers of continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core material of 2 psf polyurethane foam. Metal frames or pultruded fiberglass frames will not be accepted.
2. Finish of frame shall be identical to the door with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat result in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

3. Jamb/Header connection shall be mitered for tight fit.
 4. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware. Reinforcing material shall be a dense matrix of cloth glass fibers and premium resin with a minimum hinge screw holding value of 1000 lbs per screw. All reinforcing materials shall be completely encapsulated. Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.
- C. Hardware
1. The special nature of this material requires that all related hardware as specified must be furnished and installed by the door frame manufacturer to maintain product quality and function as well as to ensure sufficient support/reinforcement, precision tooling and proper sealing methods are provided.
- D. Color
1. Color to be Selected by Architect from Manufacturer's Full Line

PART 3 - EXECUTION

3.1 INSTALLATION CONDITIONS

- A. Verification of Conditions
1. Verify openings are correctly prepared to receive doors and frames.
 2. Verify openings are correct size and depth in accordance with submittal drawings.
- B. Installer's Examination
1. Door installer shall examine conditions under which construction activities of this section are to be performed and submit a written report to general contractor if conditions are unacceptable.
 2. General Contractor shall submit two copies of the installer's report to the architect within 24 hours of receipt.
 3. Installer shall not proceed with installation until all unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Doors shall be delivered at job site individually crated. Each crate to be clearly marked with the specific opening information for quick and easy identification.
- B. All single doors to be shipped completely assembled in the frame with hardware installed. Double doors to be pre-hung at the factory to ensure a proper fit and that hardware functions properly, then disassembled for shipping purposes.
- C. Install door opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in

installation instructions.

- D. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
- E. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions.
- F. Fire labeled doors, frames and any associated hardware must be installed by qualified professional installers in strict accordance with manufacturer's instructions and the latest revision of NFPA 80.

3.3 ADJUSTING

- A. Adjust doors in accordance with the door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
- B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instruction.

3.4 CLEANING

- A. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

3.5 PROTECTION

- A. After erection of doors and frames, precautionary methods shall be employed to adequately protect exposed surface on installed items from damage due to installation of other work or from lime, acid, cement or other harmful compounds.
- B. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 08 16 13

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Overhead coiling doors.
2. Operating hardware.
3. Electric operation.
4. Wiring from electric circuit disconnect to door operator to control station.

B. Related Requirements:

1. Section 042200 – Concrete Unit Masonry: Supporting wall construction.
2. Section 087100 - Door Hardware: Product requirements for cylinder core and keys for placement by this Section.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

B. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

C. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA ICS 2 - Controllers, Contactors and Overload Relays Rated 600 V.
3. NEMA MG 1 - Motors and Generators.

D. National Fire Protection Association:

1. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.

E. UL:

1. UL - Building Materials Directory.
2. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
3. UL 1784 - Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit general construction details, component connections, wiring diagrams, and electrical equipment details.
- C. Shop Drawings: Indicate relevant dimensioning, anchorage methods, hardware locations, and installation details for applicable supporting wall construction.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit installation sequence and procedures, and adjustment and alignment procedures.
- F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- H. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

1.4 QUALITY ASSURANCE

- A. Labels:
 1. Identification: Attach label from agency approved by authority having jurisdiction to identify each fire-rated door.
 2. Oversize Door Certification: Furnish UL Certificate of Inspection, or comparable certification acceptable to authority having jurisdiction, in lieu of label for oversize door assemblies exceeding 120 sq. ft. (11.15 sq. m) or 24 feet (7.3 m) in any dimension.
- B. Products Requiring Electrical Connection: Listed and classified by UL or another testing firm acceptable to authority having jurisdiction.
- C. Surface-Burning Characteristics:

1. Foam Insulation: Maximum 75/450 flame-spread/smoke-developed index when tested according to ASTM E84.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

1.7 EXISTING CONDITIONS

- A. Field Measurements:
 1. Verify field measurements prior to fabrication.
 2. Indicate field measurements on Shop Drawings.

1.8 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish minimum five-year manufacturer's warranty for overhead coiling doors.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Door Assembly:

1. Wind/Suction Load: 20 psf (958 Pa).
2. Maximum Deflection: 1/120 of span without damage to door or assembly components.

B. Operation of Door Assembly and Operator: Minimum 10,000 cycles.

2.2 OVERHEAD COILING DOORS

A. Manufacturers subject to compliance with specification:

1. Basis Of Design: Wayne-Dalton Corp. Model ThermoTite 800c (Aluminum)
2. C.H.I. Overhead Doors, Inc.
3. Clopay Building Products.
4. Overhead Door Corporation.
5. Raynor Garage Doors.
6. Substitutions: Must be approved by Owner & Architect.

B. Description:

1. Electric Operation:
 - a. Operator: Electric motor.
 - b. Furnish manual override in case of power failure.

C. Curtain:

1. Slats:
 - a. Type:
 - 1) Interlocking.
 - 2) Single-thickness; flat.
 - b. Material:
 - 1) Aluminum alloy, Type 6063.
 - 2) Comply with ASTM B221.
 - c. Minimum Thickness: 0.040 inch (1 mm).
 - d. Nominal Size: 2-3/4 inches (70 mm) wide by required length.
 - e. Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with aluminum angles, channels, or hollow extrusion to provide reinforcement and to maintain positive contact with floor in closed position.
3. Guides:
 - a. Description:
 - 1) Formed aluminum angles. (or as recommended by manufacturer for durability in high corrosion environment)
 - 2) Configuration: Continuous.

- b. Minimum Thickness: 0.1875 inch (5 mm).
- c. Mounting:
 - 1) Orientation: Vertical.
 - 2) Brackets: Stainless steel.

D. Roller Shaft Counterbalance:

- 1. Description:
 - a. Steel pipe capable of supporting curtain load with maximum deflection of 0.03 in./ft. (2.5 mm/m) of width.
 - b. Helical steel spring system capable of producing torque sufficient to ensure smooth operation of curtain from any position, and capable of holding position at mid-travel.
 - c. Furnish adjustable spring tension.

E. Hood Enclosure:

- 1. Shape: Manufacturer's Standard.
- 2. Material:
 - a. Aluminum.
 - b. Minimum Thickness: 0.040 inch (1 mm).
- 3. Internally reinforced to maintain rigidity and shape.

F. Hardware:

- 1. Locks:
 - a. Locations: All Overhead Doors.
 - b. Electric Doors:
 - 1) Manufacturer's standard cylinder locking system to secure door.
 - 2) Interlock with motor to prevent motor from operating when lock is activated.
- 2. Cylinders:
 - a. As specified in Section 087100 - Door Hardware.
 - b. Minimum Number of Pins: Seven.
 - c. Doors keyed alike.
- 3. Handle:
 - a. Mounting: Inside side.
 - b. Keeper: Adjustable.
 - c. Latch Bar: Spring activated, with feature to keep in locked or retracted position.
 - d. Handle: Interior.
- 4. Weatherstripping of Exterior Assemblies:

- a. Moistureproof, rot-proof, and resilient.
- b. Air Infiltration Rate:
 - 1) 0.66 cfm/sq. ft (3.30 L/s per sq. m).
 - 2) Comply with ASTM E283.
- c. Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides with safety edge as specified.
- d. Guides: Vinyl strip sealing against fascia side of curtain.
- e. Hood: Neoprene/rayon baffle to impede air flow above coil.
- f. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.

2.3 ELECTRIC OPERATOR

A. Description:

- 1. Comply with UL 325.
- 2. Mounting: Wall Mount.

B. Electrical Characteristics:

- 1. 3/4 hp (550 W).
- 2. Voltage: 115 V, single phase, 60 Hz.
- 3. Contractor to verify electrical load requirements with Door Operator Manufacturer.
- 4. Motors:
 - a. Type: Totally enclosed, nonventilated.
 - b. Enclosure: NEMA MG 1 Type 4.
 - c. Rating: Industrial duty.
 - d. Controller:
 - 1) NEMA ICS 2, full voltage.
 - 2) Motor Starter: Reversing magnetic.
 - 3) Enclosure: NEMA 250 Type 4.
- 5. Door Speed: 12 in./s (300 mm/s).
- 6. Brake:
 - a. Type: Adjustable friction clutch.
 - b. Activation: By motor controller.

C. Control Station:

- 1. Type: Standard three buttons; OPEN-STOP-CLOSE.
- 2. Button Control: Constant pressure.
- 3. Circuit: 24 V.
- 4. Mounting: Surface.

D. Safety Edge:

- 1. Manufacturer's standard with weatherseal.

2. Type: Full width; sensitized.
3. Location: Door bottom.
4. Wired to stop and reverse upon encountering obstruction.

E. Photo Eye Sensors:

1. Manufacturer's standard; comply with NEMA 4.
2. Transmitter and Receiver:
 - a. Mounting: Within 6 inches (150 mm) of floor.
 - b. Infrared Beam: Projecting across opening and wired to stop and reverse upon interruption of beam.

2.4 FINISHES

A. Curtain Slats and Bottom Bar:

1. Aluminum:
 - a. Finish: Mill.
 - b. Color: Clear Anodized.

B. Guides and Hood Enclosure: Match finish of door.

2.5 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Provide shop inspection and testing of completed assembly.
- C. Certificate of Compliance:
 1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
 2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that opening sizes, tolerances, and conditions are acceptable.
- C. Verify that supplementary support framing installed under other Sections is ready to receive doors and operators.

3.2 INSTALLATION

- A. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- B. Securement:
 - 1. Securely and rigidly brace components suspended from structure.
 - 2. Secure guides to structural members only.
- C. Fit and align assembly, including hardware, level and plumb to provide smooth operation.
- D. Install fire-rated door assemblies according to NFPA 80 and requirements for fire listing.
- E. Electric Operators:
 - 1. Complete wiring from disconnect to unit components and control stations.
- F. Sealants and Backing Materials: As specified in Section 079000 - Joint Protection.
- G. Install perimeter trim and closures.

3.3 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maintain dimensional tolerances and alignment with adjacent Work.
- C. Maximum Variation from Plumb: 1/16 inch (1.5 mm).
- D. Maximum Variation from Level: 1/16 inch (1.5 mm).
- E. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet (3 mm per 3 m) straight edge.

3.4 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Testing:
 - 1. Test for proper operation.
 - 2. Control System: Start by energizing system equipment and testing operation of hardware and control logic under supervision of manufacturer's representative and in presence of Engineer or Owner.
 - 3. Test fire- and smoke-activated assemblies for proper activation.
 - 4. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.

- C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.
- D. Equipment Acceptance:
 - 1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
 - 2. Make final adjustments to equipment under direction of manufacturer's representative.

3.5 ADJUSTING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Adjust door, hardware, and operating assemblies for smooth and noiseless operation.

3.6 CLEANING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean door and components.
- C. Remove labels and visible markings.

3.7 DEMONSTRATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 08 33 23

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Hardware for fiberglass doors.
2. Additional Key Cores for Overhead Doors
3. Thresholds.
4. Weatherstripping and gasketing.

B. RELATED REQUIREMENTS

1. Section 081613 – Fiberglass Doors and Frames.
2. Section 083323 - Overhead Coiling Doors.

1.2 REFERENCE STANDARDS

A. Accessibility Standards:

1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. Builders Hardware Manufacturers Association:

1. BHMA A156.1 - Standard for Butts and Hinges 2021.
2. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.
3. BHMA A156.4 - Door Controls - Closers 2019.
4. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.
5. BHMA A156.16 - Auxiliary Hardware 2018.
6. BHMA A156.18 - Materials and Finishes 2020.
7. BHMA A156.21 - Thresholds 2019.
8. BHMA A156.26 - Standard for Continuous Hinges 2021.
9. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.

C. Door and Hardware Institute:

1. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
2. DHI (KSN) - Keying Systems and Nomenclature 2019.

D. NFPA:

1. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
2. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
3. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

4. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.
- C. Furnish templates or hardware for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- D. Keying Requirements: Verify with Owner

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components. Submit only relevant product data, submittal of entire door hardware catalog will not be accepted.
- C. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
 - 1. Closers: Ten years, minimum.
 - 2. Exit Devices: Five years, minimum.
 - 3. Locksets and Cylinders: Ten years, minimum.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Closers:
 - 1. Provide door closer on each exterior door, unless otherwise indicated.
 - 2. Provide door closer on each fire-rated and smoke-rated door.
 - 3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
- D. Overhead Stops and Holders (Door Checks):
 - 1. Provide a stop for every swinging door, unless otherwise indicated.
 - 2. Overhead Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.
 - 3. Overhead stop is not required if a floor or wall stop has been specified for the door.
- E. Drip Guards: Provide at head of outswing exterior doors unless protected by roof or canopy directly overhead.
- F. Thresholds:
 - 1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.
- G. Smoke and Draft Control Seals:
 - 1. Provide gasketing for smoke and draft control doors that comply with local codes, requirements of assemblies tested in accordance with UL 1784.

- H. Weatherstripping and Gasketing:
 - 1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 - 2. Provide door bottom sweep on each exterior door, unless otherwise indicated.
- I. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide Stainless steel Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 - 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 - 4. Provide wall grip inserts for hollow wall construction.
 - 5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - a. NFPA 101.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

2.3 CONTINUOUS HINGES

- A. Manufactures:
 - 1. Best Access
 - 2. Roton
 - 3. Select Hardware
- B. Geared Continuous Hinges: As applicable to each item specified.
 - 1. Non-handed.
 - 2. Anti-spinning through-fastener.
 - 3. Sufficient size to permit door to swing 180 degrees
 - 4. Finishes: See Door Hardware Schedule.

2.4 LOCK CYLINDERS

- A. Manufacturers:
 - 1. Best Access
 - 2. Sargent
 - 3. Schlage
- B. Material:
 - 1. Manufacturer's standard corrosion-resistant brass alloy.
- C. Types: As applicable to each item specified.
 - 1. Patented small format interchangeable core (SFIC) type cylinders, with seven pin cores.
- D. Applications: At locations indicated in hardware sets, and as follows
 - 1. As required for items with locking devices provided by other sections, including at elevator controls and cabinets.
 - a. When provisions for lock cylinders are referenced elsewhere in the Project Manual to this Section, provide compatible type of lock cylinder, keyed to building keying system, unless otherwise indicated.

2.5 MORTISE LOCKS

- A. Manufacturers:
 - 1. BEST, 45H Series
 - 2. Schlage Lock Company L9000 Series.
 - 3. Sargent 8200 Series
- B. Properties:
 - 1. Mechanical Locks: Manufacturer's standard.
 - a. Fitting modified ANSI A115.1 door preparation.
 - b. Door Thickness Coordination Fitting 1-3/4 inch (44 mm) to 2-1/4 inch (57 mm) thick doors.
 - c. Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel.
 - i. Latch bolt Throw: 3/4 inch (19 mm), minimum.
 - d. Auxiliary Deadlatch: One-piece stainless steel, permanently lubricated.
 - e. Backset: 2-3/4 inch (70 mm).
 - f. Lever Trim:
 - i. Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latch bolt assembly.
 - ii. Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
 - iii. Spindle: Designed to prevent forced entry from attacking of lever.
 - iv. Independent spring mechanism for each lever.
 - 1. Trim to be self-aligning and thru-bolted.

- C. Finishes: See Door Hardware Schedule.
 - 1. Core Faces: Match finish of lockset.
- D. Products: Mortise locks, including standard and electrified types.
 - 1. 45H

2.6 CLOSERS

- A. Manufacturers subject to compliance with specification:
 - 1. Dorma 8900 Series
 - 2. LCN 4040XP Series
 - 3. Sargent 351 Series
- B. Grades:
 - 1. Closers: Comply with BHMA A156.4, Grade 1
 - 2. Underwriters Laboratories Compliance:
 - a. Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
 - b. UL 228 – Door Closers-Holders, With or Without Integral Smoke Detectors.
- C. Installation:
 - 1. Mounting: Includes surface mounted installations.
 - 2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
 - 3. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.

2.7 OVERHEAD STOPS AND HOLDERS

- A. Manufacturers:
 - 1. Architectural Builders Hardware Mfg (ABH)
 - 2. Glynn Johnson
 - 3. Rixson
- B. Sizes: Manufacturer's standard for the application.
- C. Finishes:
 - 1. Arms and Brackets: US32D
- D. Grades: As applicable to item specified.
 - 1. Comply with BHMA A156.8, Grade 1.
- E. Types:
 - 1. Surface-applied
 - 2. Concealed
- F. Products:
 - 1. Surface Overhead Stops and Holders:
 - a. 900 Heavy Duty
 - b. ABH: 9020 Series

- 2. Concealed Overhead Stops and Holders:
 - a. 910 Heavy Duty
 - b. ABH: 1020 SL Series

2.8 STOPS AND HOLDERS

- A. Manufacturers:
 - 1. Trimco
 - 2. Hiawatha
 - 3. Burns
- B. General: Provide overhead stop/holder when wall or floor stop is not feasible.
- C. Grades:
 - 1. Door Holders, Wall Bumpers and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

2.9 THRESHOLDS

- A. Manufacturers:
 - 1. National Guard Products, Inc:
 - 2. Hager
 - 3. Reese
- B. Properties:
 - 1. Threshold Surface: Fluted horizontal grooves across full width.
- C. Grades: Thresholds: Comply with BHMA A156.21.
- D. Material: Base metal as indicated for each item by BHMA material and finish designation.
- E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
 - 1. Saddle Thresholds: Without thermal break.
 - 2. Bumper Seal Thresholds with Gasket: Use neoprene gaskets.

2.10 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
 - 1. National Guard Products, Inc.
 - 2. Hager
 - 3. Reese
- B. Products:
 - 1. Weatherstripping: See Door Hardware Schedule
 - 2. Smoke Seals: See Door Hardware Schedule
 - 3. Meeting Stile Seals: See Door Hardware Schedule
 - 4. Door Bottom Seals:
 - a. Door Sweeps: See Door Hardware Schedule

2.11 KEYS AND CORES

- A. Manufacturers
 - 1. Best, New CORMAX Patented Key System.
- B. Properties: Complying with guidelines of BHMA A156.28
 - 1. Provide small formal interchangeable core.
 - 2. Provide keys and cores.
 - 3. Provide keying information in compliance with DHI (KSN) standards.
- C. Keying Schedule: Arrange for a keying meeting, with Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware are functionally correct and keying complies with project requirements.
- D. Keying: Master keyed.
- E. Include construction keying and control keying with removable core cylinders.
- F. Supply keys in following quantities (verify with owner):
 - 1. Master Keys: 4 each, each group
 - 2. Construction Control Keys: 2 each
 - 3. Change Keys: 2 each change keys for each keyed core
- G. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
- H. Include installation of permanent cores and return construction cores to hardware supplier.
- I. Construction cores and keys to remain property of hardware supplier.

2.12 FINISHES

- A. Finishes: Identified in Hardware Sets.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Correct all defects prior to proceeding with installation.
- C. Verify that electric power is available to power operated devices and of correct characteristics.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware using the manufacturer's fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.
- C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- D. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- E. Use templates provided by hardware item manufacturer.
- F. Do not install surface mounted items until application of finishes to substrate are fully completed.
- G. Wash down masonry walls and complete painting or staining of doors and frames.
- H. Complete finish flooring prior to installation of thresholds.
- I. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 014000 – Quality Requirements.
- B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation activities.

3.5 PROTECTION

- A. Protect finished Work under provisions of Section 017000 – Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

Manufacturer List

Code	Name
AB	ABH Manufacturing Inc.
BE	Best Access Systems
BY	By Related Section
DM	Dorma Door Controls
JOHN	Johnson Hardware
NA	National Guard
PR	BEST Precision Exit Devices
RC	RCI
ST	BEST Hinges and Sliding
TR	Trimco
YL	Yale

Option List

Code	Description
1/4-20 SSMS/EA	Stainless Machine Screws/Expansion Anchors.
B4E-HEAVY-KP	Beveled 4 Edges - Kick Plates
BSHD	Blade Stop Spacer - Heavy Duty Arms
C	Quick Connect Wiring System
CD	Cylinder Dogging
CSK	Counter Sinking Of Kick And Mop Plates
DP89	Drop Plate for PA for Top Rail <5 3/4"
EPT Prep	EPT Prep (full mortise)
HT	Hospital Tips-Heavy Weight
LBR	Less Bottom Rod
LD	Less Dogging
MLR	Motorized Latch Retraction
N	Thru-Bolt w/ Flow-Thru
NFHD	Narrow Frame Bracket - Heavy Duty Arms
SEC	Security Screws
SH	Security Head Screws
SIA	Abrasive Coating-5" Width-Al Or Ss
SN1	Set (4) Sex Nuts - 1 3/4" Doors (Std)
SPANNER 1/4-20 SSMS/LA	Stainless Spanner Head Ms/Lead Anchor
STAINLESS SPANNER HEAD SMS 8 X 3/4"	Spanner Head Screws 8 X 3/4"
Torx Screws	Torx Head Screws (Each) - Excluding Bolt
TORX SCREWS	Torx Screws (8) - Steel
TORX SCREWS 6 X 3/4"	Torx Security Screws 6 X 3/4"
TS	Touchbar Monitoring Switch

TX89
VIB

Torx Fasteners (Exposed Screws)
Double Visual Indicator Option

Finish List

Code	Description
26D	Satin Chrome
32D	Satin Stainless Steel
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
689	Aluminum Painted
AL	Aluminum
GREY	Grey
US32D	Stainless Steel, Dull

DOOR HARDWARE SCHEDULE:

The following Door hardware schedule is a spec set for each opening, not to be confused with a detailed hardware schedule as provided by a hardware supplier or an architectural hardware consultant.

The Contractor shall consult with a door hardware representative to coordinate all following hardware selections with the door and hardware manufacturers to ensure compatibility for specific applications and to achieve specified door operation description.
The Contractor Shall coordinate with the Owner to Verify Existing Hardware and Keying system in the field and coordinate with the new specified hardware.

The following hardware sets are intended to establish type and standard of quality when used together with requirements of this Section. Examine Drawings and Specifications and furnish proper hardware for door openings.

Provide Key Cores for Overhead Door Manufacturer's standard cylindrical locking system

Hardware Sets**Set #001 – Personnel Door**

Door: 100

1	Continuous Hinge	662HD UL	AL	ST
1	Office (AB) Lockset	45H7A14S630AM	630	BE
1	Closer	STA 8916 S-DS	630	DM
1	Drip Cap	16 A - 4" ODW		NA
1	Gasketing	700 NA @ Head & Jambs		NA
1	Door Sweep	200 NA		NA
1	Threshold	896 N 1/4-20 SSMS/EA	AL	NA

NOTE: Contractor to coordinate door hardware with Door manufacturer and Architectural Hardware Representative to verify compatibility and desired operation.

Operation: Door normally closed and locked. Mechanical key unlocks door Deadbolt from exterior or thumb turn interior. Egress is always allowed.

Door and frame supplier to coordinate with hardware supplier for required hardware preps.

OPENING LIST**First Floor**

Opening	Hdw Set	Door Type	Frame Type	Notes
100	001	FG	FG	
101	GARAGE	AL	--	Provide Key Core
102	GARAGE	AL	--	Provide Key Core

END OF SECTION 08 71 00

SECTION 09 91 23

PAINTING

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 surface preparation and the application of paint systems on the following exterior and interior substrates:

1. Concrete masonry units (CMU).
2. Steel
3. Galvanized metal
4. Mechanical and electrical work (MEP)

- B. Related Sections include the following:

1. Division 3 Sections "Concrete" for sealers of concrete flatwork.
2. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.

1.3 SUBMITTALS

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

- B. Samples for Initial Selection: Upon request, for each type of topcoat product indicated.

- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
5. Label each sample as to date painted.

- D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples 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.

1.5 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 (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents. Furnish an additional 1 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Sherwin-Williams Company
2. Benjamin Moore & Co.
3. Duron, Inc.
4. Finnaren & Haley Inc (F&H)
5. M.A.B. Paints.
6. Porter Paints.

7. PPG Pittsburg Paints

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: To be selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

A. Solvent Based Two Part Epoxy Block Filler: MPI #116.

2.4 METAL PRIMERS

A. Zinc Rich Epoxy Primer, MPI #20.

2.5 WOOD PRIMERS

A. Exterior Latex-Based Wood Primer: MPI #6

B. Interior Latex-Based Wood Primer: MPI #39.

2.6 EPOXY PAINT

A. Water-Based Epoxy (Interior and Exterior): MPI #115. A water based, two component epoxy type, Gloss finish coating. Subject to compliance with requirements, provide one of the following:

1. Benjamin Moore & Co.; Acrylic Epoxy Gloss "A", Hardener "B", M43/M44.
2. ICI Paints; Devoe Coatings, Tru Glaze WB Epoxy Gloss Coating, 4408/4418
3. Porter Paints; Dura-Glaze WB, Gloss Epoxy, 9371.
4. PPG Architectural Finishes, Inc.; Aquapon, Waterborne Epoxy, 98-1/98-98.
5. Sherwin-Williams Company (The); Industrial & Marine, Water Based Catalyzed Epoxy, B70W 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 work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry: 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates 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 plates, machined surfaces, and similar items already in place that 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.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
 - 2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - 3. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

4. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting
- D. Concrete Masonry Substrates: Remove 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 and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- F. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
1. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 3. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. 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.
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.
- 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. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- F. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- G. Overhead Structure and Exposed Ceiling Steel and Galvanized-Metal Substrates:
 - 1. Prep substrate as required minimum. Repair existing primed surfaces.
 - 2. Galvanized surface shall be prepared by either solvent cleaning and test for chromate passivation, with an SSPC SP 7 Brush-off blast cleaning if required or chemical-etching cleaners may be substituted for solvent washing and SSPC-SP 7 cleaning.
 - 3. Apply organic zinc rich primer coat to unprimed surfaces.
 - 4. Paint exposed metal deck, structural steel, conduit, un-insulated ductwork and piping, and other mechanical and electrical work. Protect surfaces not to be painted.
- H. Exterior Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed on exterior of building, excluding roof mounted mechanical and electrical work. Items to be painted include, but are not limited to, the following:
 - 1. Uninsulated metal and plastic piping, including hangers and supports.
 - 2. Louvers, grilles, vents unless prefinished.
 - 3. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 4. Conduit and junction boxes.
 - 5. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - 6. Do not paint unless noted otherwise.
 - a. Prefinished mechanical equipment and items
 - b. pipe and duct insulation
 - c. Prefinished electrical devices and/or cover plates
 - d. Electrical fixtures
 - e. Nameplates
 - f. Moving parts
 - 7. Touch up damaged finishes, including field applied and pre-finished surfaces.
- I. Interior Mechanical and Electrical Work: Unless otherwise noted, painting of mechanical and electrical work is limited to items exposed to view in finished spaces as defined herein.
 - 1. Locations where MEP work to be field painted include following:

- a. Occupied or Finished Spaces without ceilings - Paint all exposed MEP work as described herein exposed to view, including the structure above - unless noted otherwise.
- 2. Items to be painted include, but are not limited to, the following:
 - a. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - b. Uninsulated metal and plastic piping
 - c. Piping hangers and supports.
 - d. Louvers grilles vents unless prefinished
 - e. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - f. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - g. Conduit and junction boxes, including metallic and PVC materials, fire alarm, BAS, attachments exposed and semi-exposed to view in finish areas
 - h. Electrical and control panels in finish areas and exposed to view
- 3. Do not paint, unless noted otherwise.
 - a. Prefinished mechanical equipment and items
 - b. pipe and duct insulation
 - c. Prefinished electrical devices and/or cover plates
 - d. Electrical fixtures
 - e. Nameplates
 - f. Moving parts
 - g. Sight exposed interior of ductwork and other equipment
- 4. Touch up damaged finishes, including field applied and pre-finished surfaces.

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.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Exterior steel shall be Hot-Dipped Galvanized unless noted otherwise, see sections 051200 “Structural Steel Framing” and 055100 “Metal Stairs” for galvanized finish requirements.
- B. Painted Exterior Steel Substrates:
 - 1. Water-Based Epoxy Coating System (MPI Gloss Level 6):
 - a. Prime Coat: Organic Zinc Rich Epoxy Primer, MPI #20
 - b. Intermediate Coat: Same as topcoat.
 - c. Topcoat: Solvent Based High-performance Epoxy, MPI #98
- C. Wood Substrates:
 - 1. Latex System MPI EXT 6.4K:
 - a. Prime Coat: Primer, bonding, water based, MPI #6.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
- D. CMU Substrates:
 - 1. See Section 042200 Concrete Unit Masonry for exterior CMU Sealing

3.6 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. Water-Based Epoxy Coating System (MPI Gloss Level 6):
 - a. Block Filler First Coat: Latex block filler, MPI #116.
 - b. Block Filler Second Coat: Latex block filler, MPI #116.
 - c. Intermediate Coat: Same as Topcoat.
 - d. Topcoat: Solvent Based High-performance Epoxy, MPI #77
- B. Interior Steel Substrates:
 - 1. Water-Based Epoxy Coating System (MPI Gloss Level 6):
 - a. Prime Coat: Organic Zinc Rich Epoxy Primer, MPI #20
 - b. Intermediate Coat: Same as topcoat.
 - c. Topcoat: Solvent Based High-performance Epoxy, MPI #98
- C. Interior Galvanized-Metal Substrates:
 - 1. Water-Based Epoxy Coating System (MPI Gloss Level 6):
 - a. Prime Coat: Organic Zinc Rich Epoxy Primer, MPI #20
 - b. Intermediate Coat: Same as topcoat.
 - c. Topcoat: Solvent Based High-performance Epoxy, MPI #98

D. Wood Substrates: Wood trim

1. Latex over Latex Primer System MPI INT 6.3T:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

END OF SECTION 09 91 23

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide J.L. Industries, Inc. "Cosmic 10E" or comparable product by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - g. Larsen's Manufacturing Company.
 - h. Moon-American.
 - i. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
 - j. Potter Roemer LLC.
 - k. Pyro-Chem; Tyco Safety Products.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type: UL-rated nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
- C. Units to be surface mounted on Wall. See locations on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
- C. Mounting Brackets: Provide appropriate mounting brackets for fire cabinets and wall mounted applications and fasten to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 – GENERAL

1.1 DESCRIPTION

The Contractor shall furnish and install all water mains, valves, hydrants, fittings, flexible expansion joints, and appurtenances as specified herein and as defined on the drawings or as directed by the Engineer. Provide all necessary adaptors for connection to existing mains.

1.2 SCOPE

- A. Exterior water piping, valves and appurtenances shall be as specified in this section.

PART 2 – PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA A21.51/C151, latest edition, and shall be thickness Class 50, Class 52 in streets or highway sleeves or Class 56 under railroads unless otherwise noted on the drawings or the bid form. The Contractor shall have the option of furnishing mechanical or push-on joints conforming to the latest edition of ANSI/AWWA A21.11/C111.
- B. Pipe and fittings shall have a standard external asphaltic coating approximately one (1) mil thick.
- C. Pipe and fittings shall have an internal cement lining in accordance with latest revision of ANSI/AWWA A21.4/C104. No bituminous coating shall be used on the inside of pipe and fittings.
- D. All fittings and specials shall be ductile iron. Ductile iron fittings and specials shall be full body, mechanical joint with a 250-psi pressure rating and marked in conformance with ANSI/AWWA A21.10/C110, latest edition, and ANSI/AWWA A21.11/C111, latest edition.
- E. Use Nitrile (NBR) pipe gaskets if the pipe will be in contact with volatile organic compounds. If soils are contaminated with gasoline use Neoprene or Buna-N material.

2.2 POLYVINYL CHLORIDE (PVC) PLASTIC PIPE AND FITTINGS

- A. Polyvinyl chloride pipe shall meet the requirements of AWWA C909. It shall be manufactured in standard length not exceeding twenty (20) feet and have an outside diameter equal to cast iron pipe. PVC pipes shall have standard dimension ration (SDR) of 18.0. The pipe shall be rated for a working pressure of at least 200 psi.
- B. Polyvinyl chloride (PVC) pipe shall be manufactured with an elastomeric-gasket joint conforming to ASTM D3139. Pipe ends shall be beveled.

- C. Fittings for PVC water main shall be cast iron or ductile iron as specified in 2.1, above.
- D. The Contractor shall provide all necessary adapters for connecting PVC pipe to cast iron fittings and valves or other pipelines. Adapters shall be as recommended by the pipe manufacturer. Furnishing and installing adapters shall be included in the prices bid for the pipe.
- E. Polyvinyl chloride pipe shall be delivered and stockpiled in unit pallets. Store pipe on flat surface. No stacking of pallets or random lengths above five (5) feet in height will be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitable covered with reflective materials to protect the pipe from ultra-violet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.
- F. Bowed sections of pipe will not be acceptable and will not be allowed to be installed on this project.

2.3 POLYETHYLENE (PE) PIPE AND FITTINGS

- A. Polyethylene (PE) pipe shall be SDR 9, or as indicated on the drawings, and plain end for fusion welding conforming to ASTM F714 and ASTM D3035. Minimum pressure rating shall be 200 psi.
- B. The pipe, fittings and specials shall be from the same manufacturer. All fittings and specials shall have the same pressure rating as the pipe.
- C. Molded fittings will conform to ASTM F714. End sections of PE piping in directional bores shall have an AWWA C207 Class D flange end butt fusion welded to PE main where connecting to other materials. Flange shall be drilled to standard 125-pound template. End connections shall not be made until the PE pipe has had sufficient time to rebound, per manufacturer's recommendations.
- D. All pipe and fittings joints shall be fully restrained from movement due to thermal expansion/contraction forces.
- E. Joints for the pipe and fittings shall be by butt fusion joining techniques in accordance with the manufacture's recommendations. Where joining pipe is required within the trench, electrofusion techniques may be used in lieu of butt fusion. Electrofusion couplings and saddles may be used where necessary. All Electrofusion couplings shall be made using a computer controlled automatic electrofusion system. The electrofusion system shall consist of couplings containing an integral heating source which is computer controlled for time, temperature, and jointing pressure for a consistent joint. Couplings shall be rated for the same working pressure as the pipe and shall have a built-in identification feature to automatically set fusion times. The electrofusion system shall include a current monitoring feature. All joints shall be made in accordance with the manufacturer's instructions. The use of mechanical couplings for making joints is prohibited.
- F. All HDPE fittings shall be of the type specified. They shall be of the same material and fully pressure rated to meet or exceed the pressure rating of the pipe.

2.4 GATE VALVES & BOXES

- A. Gate valves shall be furnished and installed where indicated on the drawings. Each gate valve shall conform to AWWA C509 for resilient wedge gate valves. The cast iron gate valves shall be epoxy coated inside and out.
- B. The valve stem shall be constructed of manganese bronze and sealing shall be accomplished by dual o-rings allowing replacement of o-ring seals while the valve is open and under pressure. Buried valves shall be equipped with a two-inch square operating nut.
- C. Gate valves shall be provided so that inconvenience and sanitary hazards will be minimized during repairs. Gate valves shall be located where practical with in or adjacent to street property lines and out of the roadway when possible.
- D. Gate valves shall be supported on solid concrete blocks and plumbed level with existing pipe.
- E. The operating nut on buried valves shall not be more than 4' below finished grade. A valve stem extension with accessory guide ring shall be used to raise the operating nut to the required height. The stem extension shall be pinned to the existing valve stem operating nut.
- F. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or seating.
- G. Gate valves shall open-left.
- H. Provide each gate valve with a 5-1/4-inch diameter Buffalo screw type valve box with "WATER" cast in the lids. All boxes for 4, 6- and 8-inch valves shall be equipped with #6 round base. Ten (10) inch and larger valves shall be equipped with #8 valve box base. Valve boxes shall be adjustable between 2' - 4" and 3' - 4" except when deeper settings are required. Lids shall be extra deep and have two holes for removal of lid.
- I. Provide operating wrenches.

2.5 TAPPING SLEEVE & VALVE

- A. Tapping sleeves shall be iron body mechanical joint type. Tapping sleeve and valve assemblies shall be supported by concrete blocks and bricks and plumbed level with the existing pipe. The pipe to be tapped and all components of the tapping sleeve assembly shall be disinfected per AWWA C651 for Cutting into or Repairing Pipe.
- B. Install tapping sleeve and valve per manufacturer's recommendations.

2.6 CUT-IN VALVES & SLEEVES

- A. Cut-in sleeve types and sizes shall be cast iron and size shall be based on actual field measurement by the Contractor.
- B. Install sleeves and valves per manufacturer's recommendations.

2.7 FIRE HYDRANTS

- A. Fire hydrants shall be installed per the Owner's Standards. Hydrants shall be compression type with a 5-1/4-inch main valve opening, two 2-1/2 inch hose nozzles, one 4-1/2 inch pumper nozzle, and a 6 inch mechanical joint hub base. Hydrant seats shall be provided with bronze to bronze threaded connections.
- B. All nozzle and steamer threads shall conform to National Standard. Hydrants shall be of proper length for a 4-foot trench depth or as required by field conditions. They shall meet the requirements of AWWA C502.
- C. A sworn certificate of inspection and testing shall be furnished by the manufacturer. Install hydrants with restraint system as detailed on the drawings.
- D. All hydrants to be furnished with non-kinking chains on the 2 1/2 inch nozzles.
- E. Pump nozzle shall be 5" Storz connection; contractor to specify to supplier that the hydrant is for Worcester County Public Works and to ensure proper hydrant and proper connections included.
- F. Hydrants shall open by turning the operating nut counterclockwise.
- G. Fire hydrants to receive one (1) coat of primer and two (2) coats of chrome yellow paint in accordance with Federal Standards 595A. The final coat shall be field applied after the hydrant has been installed.
- H. Ductile iron pipe with cast iron or ductile iron fittings shall be used exclusively throughout the hydrant assembly. The use of PVC pipe will not be permitted in the construction of any portion of the hydrant leads.
- I. Provide a minimum of two (2) hydrant operating wrenches and two (2) repair kits per project, and a minimum of one (1) per every five (5) hydrants installed.

2.8 PIPELINE TRACER WIRE AND LOCATION CONNECTION

- A. For direct burial applications, wire shall be fastened directly to the top of the proposed water main. Tracer wire shall be #12 AWG High Strength Tracer Wire, by Copperhead Industries, LLC of Monticello, MN, or approved equal. The wire shall be rated for 2032 pounds break strength and insulation shall be 30 mil and rated for direct bury use at 30 volts.
- B. Splicing of tracer wire shall not be permitted. Tracer wire shall be terminated with magnetized tracer boxes. Tracer boxes shall be installed as shown on the plans or as directed by the County/Engineer. Boxes shall be installed on the backside of the proposed main and shall be rated for the surface condition in which it is installed. All boxes shall have a cast iron locking cover with the APWA color code standard (**BLUE**) for this buried utility. Locator box shall be Copperhead Part number RB14*2T-SW or approved equal.

2.9 PIPE RESTRAINT SYSTEMS

- A. Joint restraints shall be installed at all fittings and valves. Buttresses shall be used in all pressure lines at all valves, bends, tees, hydrants, and at reducers or other fittings where changes in direction or pipe size occur. The buttresses shall be as shown on the Drawings.
- B. Mechanical joints on C-909 PVC pipe shall be assembled using EBBA Iron Mega Lug Series 1100 Mechanical Joint Restraints, or approved equal.
- C. Where necessary push-on joints will be assembled using EBBA Iron Mega Lug Series 1700 Restraint Harness or approved equal.
- D. No pipe joints shall be encased in concrete or covered with concrete during the construction of thrust restraint buttresses.
- E. Thrust restraint of ductile cast iron pipe joints and fittings shall use ASTM A307 galvanized 3/4in steel threaded rod, nuts, and washers.
- F. Forms and supports used for buttresses shall be removed after a minimum of 24 hours prior to backfilling.

2.10 SERVICE PIPE AND APPURTENANCES

A. GENERAL

- 1. The Contractor is responsible for furnishing and installing all corporation stops, curb stops, house service pipe, valves and appurtenances as indicated on the drawings and specified herein.
- 2. The Contractor will provide a main tap complete with corp stop for all residential or commercial lots within the project area. The service will be connected to the existing meter box.
- 3. The meter setters installed by the Contractor shall accommodate the following meters:
 - a. Residential hook-up: Neptune T-10 Meter with Procoder R900i type 5/8" x 3/4".
 - b. Commercial hook-up: Neptune T-10 Meter with Procoder R900i type 2".
- 4. The Contractor shall provide all tools, equipment and accessories required for tapping ductile iron and polyvinyl chloride water mains and installing water services. All underground service lines, valves and fittings shall conform to ANSI/AWWA C800 – latest version.

B. HOUSE SERVICES

- 1. Standard water service lines shall be polyethylene tubing, 1 inch diameter, SDR-9 copper tubing size unless otherwise shown on the plans. Service lines shall conform to ASTM D-2737, 200 PSI rating.
- 2. Corporation stops shall be 1 or 2 inch as appropriate, Mueller model H-15008 or approved equal. Install stainless steel liners at connection to service lines. Liners shall be Part No. 71 or approved equal. The Contractor shall furnish and install

- liners wherever a compression connection is used on plastic service lines.
3. Cutting tools shall be of the hollow, shell bit type for removal of pipe plug. On closely spaced taps for townhouse developments, place corporation stops as recommended by pipe manufacturer. Furnish saddles with standard AWWA corporation stop inlet thread, double strapped for tapping all mains. Saddles shall be Ford stainless steel double strapped type model FS323.
 4. Meter box shall be manufactured from a co-mold, three layer HDPE that is a minimum of .55" thick. The box shall withstand 20,000 pounds of free standing vertical pressure without failure. An anti-settling flange shall be integral and located on the bottom of the box to resist post installation settlement. Meter box shall be black on the outside, to resist UV degradation and white on the inside. Meter box shall be model MMP182230, manufactured by Bingham & Taylor, or approved equal. Meter box covers shall be Type A, H-20 rated or approved equal. Meters shall be installed in unpaved areas unless approved by the County. Lids shall have the word "WATER" cast into the cover and include lifter worm locks.
 5. Meter setter with ball valve inlet and dual check valve outlet for $\frac{5}{8}$ " x $\frac{3}{4}$ " meters shall be installed in the Bingham & Taylor meter pit and be Ford PSIB-28L-18-18 NL for the inlet and Ford PSO HH-28L-18-18 NL for the outlet. Ball valves shall be Ford BA13-232W. Check valve shall be Ford HHA 31-323 or approved equal. Couplings for connection shall be Ford C-16-33 with stainless steel inserts. Meter support shall be by a lateral PVC brace.
 6. All bolts, nuts and washers within the meter pit shall be stainless steel.
 7. Supply meter box lid wrenches as follows: Ford Model Key 3-36; for 1 to 5 box covers, 1 key; for 6 to 10 box covers, 2 keys; and for greater than 10 box covers, 3 keys, or approved equal. Contractor shall verify fit and compatibility of assembly components prior to ordering.

C. COMMERCIAL SERVICE

1. All lines larger than 1" diameter shall be 2 inch diameter SDR-9 copper tubing size polyethylene pipe.
2. For tapping ductile iron pipe use Ford F202, double strap, iron service clamp with 2-inch AWWA threads and FB1000-7 corporation stop. For tapping PVC pipe use Ford FS202, stainless steel tapping saddle with 2 inch AWWA threads and FB1000-7 corporation stop. Use Teflon tape for threaded service connections. Do not torque saddles or sleeves without water pressure in main.
3. Curb valves shall be 2-inch Ford B44-777 ball valve. Curb valve boxes shall be B&T 92D screw extension type with arch base or approved equal.
4. Meter pits shall be Carson MS3036 HDPE, or approved equal. Meter pit covers shall be Monitor MC-30TT by Ford or approved equal. Provide double extra heavy covers for traffic areas. Setters shall be Ford VBHH77-18B-11-77 with 2 inch flange angle check valve, 2 inch flange angle ball valve plus a bypass ball valve with padlock wings.
5. All bolts, nuts and washers within the meter pit shall be stainless steel.

PART 3 – EXECUTION

3.1 LAYING WATER MAINS, FITTINGS AND APPURTENANCES

- A. The Contractor shall verify the dimensions of all valves, fittings, equipment, etc., so that all of the pipe work performed will fit together properly and conform to the general arrangement shown on the Drawings. All pipe valves, fittings, and related accessories shall be carefully examined for defects before installing and no defective pieces shall be installed. All pieces shall be thoroughly cleaned before they are installed and shall be kept clean and dry.
- B. Adjoining pipe, valves and/or equipment to be joined by flanges shall be blocked and shimmed to true elevation with bolt holes in perfect alignment before bolts are inserted and tightened. Bolts shall be tightened uniformly. Drawing skewed joints into gaskets between flanged connections, fittings shall be non-asbestos composition and shall be coated with thread lubricant prior to making up joints. Flange bolts, nuts and washers shall, unless otherwise shown on the drawings, be of mild steel with good, sound, well-fitted threads; the nuts shall be cold-punched, hexagonal, trimmed, and chamfered. Heads, nuts and threads shall be United States standard sizes. Bolts shall be of such length as to project one-quarter inch beyond the nut when the flanged joint with gasket is assembled.
- C. During construction, the Contractor shall keep all ends of pipes or conduits, and all equipment connections, closed with caps, plugs, or wooden flange covers, so as to prevent entrance of dirt, building materials, or other foreign matter.
- D. Water main pipe, fittings, and valves shall be installed per manufacture's printed instructions. Care shall be taken to ensure that no joints are made with unevenness or rough edges. Pipeline deflection must be kept below the manufacturer's limitations.
- E. All pipes shall be bedded on a solid foundation prior to backfilling. Defects due to settlement shall be corrected by the Contractor at their own expense. Bell holes shall be dug sufficiently large to receive same.
- F. Pipe and fittings shall be kept clean until final acceptance of the work. All open pipe ends shall be provided with plugs to keep dirt, water and other materials from entering. This plug shall be kept in place when actual pipe laying is not in progress.
- G. Excavation and backfilling for water mains and appurtenances shall be per Section 31 23 00 of these specifications.
- H. PVC pipe shall be beveled before making pipe joint.
- I. Install no pipe on frozen or frost penetrated subgrade. When directed, the Contractor shall install pipe on artificial foundations. Such foundation may consist of gravel or concrete and shall be to the dimensions and in the manner directed by the Engineer.
- J. Pipeline detectable tape shall be installed continuously along all proposed water mains. The tape shall be installed directly above the water main and 18 inches from the ground surface. The tape shall be Lineguard Type II Detectable Tape as manufactured by Lineguard, Inc. of Wheaton, Illinois, or approved equal. The tape shall be a minimum of

two inches wide, blue in color, imprinted with the words, "CAUTION -- WATER LINE BELOW", and be capable of being detected with inductive methods.

- K. Pipeline tracer wire shall be installed along proposed water main.
- L. All concrete required to construct buttresses behind plugs, tees, bends and other fittings and anchorages beneath the vertical bends shall be placed as directed and/or as shown on the plans. The cost of concrete buttressing shall be included in the appropriate unit prices bid for pipe and fittings.

3.2 LAYING SERVICE PIPE AND APPURTENANCES

- A. All service pipe shall be carefully inspected for damaged areas. All damaged pipe shall be cut out and recoupled. Pipe installed during hot weather shall be allowed to contract to normal length before backfilling. Pipes and fittings shall be bedded on a solid foundation.
- B. Fittings and valves shall be kept clean, handled carefully and installed according to the manufacturer's recommendations.
- C. Service lines in streets shall be installed by open cutting, directional bore or missile bore method utilizing an underground piercing tool such as an ACCU-punch or equal. Maximum diameter of piercing tool to be 2-1/2 inches. Based on bids received, the Owner may adjust the quantity of the various types of service installation or eliminate the use of the piercing tool as is in his best interest.
- D. Installation of services by piercing tool shall be performed with all necessary devices to assure alignment accuracy. Such devices shall include a magnetic level, launcher and aiming frame. The Contractor shall demonstrate installation procedures to the Engineer and the D.O.T. for approval prior to use.
- E. Service connections shall be installed immediately after the construction of the adjacent main. Postponement of construction of service lines will not be allowed.
- F. Requirements for sterilization and pressure testing of service connections shall be the same as specified for mains in this specification.
- G. The Contractor is responsible for locating existing services, cutting and reconnecting with all necessary adaptors or sleeves within the unit price bid for service lines. The Contractor shall obtain and pay for the services of a licensed plumber if required by code.

3.3 INSTALLING FITTINGS, HYDRANTS, GATE VALVES AND VALVE BOXES

- A. Fittings, hydrants, gate valves and valve boxes shall be placed along the water mains at the locations indicated on the drawings or where otherwise designated by the Engineer.
- B. A valve box shall be carefully placed over the bonnet of each gate valve with the top at the finished surface of the street, sidewalk or at such other elevation as the Engineer shall direct. It shall be set exactly plumb. In tamping the backfill around the box special care shall be taken to keep the box plumb and to have it firmly supported on two 4-inch-thick solid concrete blocks to avoid settlement. Any box which is found out of plumb, or which

is not firmly supported, shall be excavated, and reset in a satisfactory manner, at the Contractor's expense.

- C. Ductile iron pipe with cast iron or ductile iron fittings shall be used exclusively throughout the hydrant assembly. The use of polyvinyl chloride pipe will not be permitted in construction of any portion of the hydrant leads.

3.4 WATER MAIN TESTING

- A. The Contractor shall furnish all equipment, labor, and materials, including water, pumps, compressors, stopwatch, gauges, and meters as approved by the Engineer for testing. The Engineer shall determine the amount of main to be tested at any one time and reserves the right to separate the installation into several test sections.
- B. Test Restrictions
 - 1. Test pressure shall not be less than 1.5 times the working pressure at the highest point along the test section and shall not be less than 100 psi.
 - 2. Test pressure shall not exceed pipe or thrust-resistant design pressures.
 - 3. The hydrostatic test shall be for a 24-hour duration or as designated by the Engineer.
 - 4. Test pressure shall not vary by more than 5 psi (35 MPa or 0.35 bar) for the duration of the test.
 - 5. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desire.
- C. Pressurization: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure as stated above at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.
- D. Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed, and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left and capped in place at the discretion of the Owner.
- E. Examination: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or

joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

- F. **Leakage Defined:** Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi (35 MPa or 0.35 bar) of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
- G. **Allowable Leakage:** No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{S \times D \times \sqrt{P}}{133,200}$$

Where:

L	=	allowable leakage, in gallons per hour
S	=	length of pipe, in feet
D	=	nominal diameter of the pipe, in inches
P	=	average test pressure during the leakage test, in pounds per square inch (150 psi)

This formula is based on an allowable leakage of 11.65 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

When hydrants are in the test section, the test shall be made against closed hydrant valves and open gate valves.

3.5 DISINFECTION AND BACTERIOLOGICAL TESTS

- A. Upon completion of water main construction, disinfect main and appurtenances. Disinfection shall be done in accordance with AWWA C601, latest edition. Contractor shall submit a plan of disinfection for approval by the Engineer.
- B. After the applicable retention period, the heavily chlorinated water shall be flushed from the main. This water shall be discharged to the sanitary sewer system. Only after water leaving the main is no higher in chlorine concentration than normal drinking water will a discharge to storm drains be allowed. Convey flushed water to discharge point in a closed sewer system.
- C. Affidavits of compliance certifying the water sampled from the water mains to be free of coliform bacteria shall be submitted to the Engineer. The contractor is responsible for requesting tests from third party lab certified in the State of Maryland. They shall provide written documentation when a section of mains can be placed in service.
- D. The contractor shall place in each length of pipe, hydrants, hydrant branches and other appurtenances, a sufficient amount of HTH tablets to insure adequate disinfection treatment of the main after its completion. Tablets shall be fastened to the inside top of every length of pipe as laid, using gasket cement known as "Permatex No. 2".

- E. The contractor will be held entirely responsible for securing a minimum residual chlorine content of 5 p.p.m. at the extremities of the mains after twenty-four (24) hours or more contact with the full water pressure on the main.
- F. Water for filling the mains shall be introduced at a velocity of less than 1 foot per second in order to permit the HTH or Perchloron to completely dissolve and have a reasonable uniform distribution throughout the mains. It is the intent of this Specification to require a sufficient amount of chemical to be equivalent to a dosage of 50 p.p.m. of chlorine.
- G. After the chlorine has been in contact with the mains or storage units for twenty-four (24) hours or longer, samples collected from the extremities of the mains shall indicate a residual chlorine content of 5 p.p.m. or more.
- H. If less than 5 p.p.m. residual chlorine is indicated, the system shall be drained, and the disinfection treatment repeated.
- I. If samples collected at the extremities indicate a residual chlorine of 5 p.p.m. or more, the system shall be flushed until there is only a normal chlorine residual (1 p.p.m. or less) present, as determined by the DPD Method Test. Samples of water shall be collected from various points along the lines, by the State Board of Health for bacteriological analysis. If Contractor so desires, they may employ at their own expense an independent laboratory, approved by the State, for performance of bacteriological analysis. If satisfactory bacteriological results are obtained, the lines may then be allowed to be placed in service. A copy of all test results shall be submitted to the Engineer.

END OF SECTION

SECTION 26 00 00
ELECTRICAL GENERAL

PART 1 GENERAL

1.1 SUMMARY

This Section includes general requirements for all electrical work. The Contractor shall furnish and install all materials, equipment, and appurtenances necessary for a complete and satisfactory installation of the electrical systems. The Contractor shall coordinate all electrical work required for the project. The Contractor shall provide the correct electrical feeder or branch circuit to each piece of electrical equipment whether or not shown on the drawings and check and coordinate feeder, branch circuit, and controls required with equipment provided under other specification sections.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE)
- B. National Fire Protection Association (NFPA)
- C. Underwriters Laboratories, Inc. (UL)
- D. National Electrical Manufacturers Association (NEMA)
- E. American Society of Testing Materials (ASTM)
- F. Association of Illuminating companies (AEIC)
- G. Insulated Cable Engineers Association (ICEA)

1.3 SUBMITTALS

- A. Submittals shall include the following information: manufacturer's name, trade name, place of manufacture, catalog model number, complete part number, nameplate data, size, layout dimensions, capacity, project specification, and paragraph reference.
- B. Shop Drawings: Submit shop drawings in accordance with the General Conditions, the Supplementary Conditions, and Section 26 00 00 Electrical General. Organize similar items into a single submittal that includes wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Shop drawings shall be specific for this project. Shop drawings which provide only generic information or are of a generic nature are not sufficient. Information within the shop drawings shall be clearly marked to identify components applicable for this project. Non-applicable information shall be noted, or neatly crossed out.
- C. Manufacturer's Catalog Data: Shop drawings shall include manufacturer's published literature and catalog data for each manufactured item. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings, circuit diagrams, and dimensional data as a minimum.
- D. Materials List: The Contractor shall submit, along with Shop Drawings, a materials list which shall include full information, including manufacturer's complete part number, regarding all

components of the equipment. Materials of construction shall be presented in the listing by ASTM reference and grade.

- E. Nameplate Information. Submit complete nameplate information for all industrial machinery. The nameplate shall include the following information:
1. Supply voltage, number of phases, frequency, and full-load current.
 2. Maximum ampere rating of the short-circuit and ground-fault protective device
 3. Ampere rating of largest motor, from the motor nameplate, or load
 4. Short-circuit current rating of the machine industrial control panel. Short-circuit current rating shall be based on the short-circuit current rating of a listed and labeled machine control enclosure or assembly. Or the short-circuit current rating shall be as established utilizing an approved method.
 5. Electrical diagram number, or the number of the index to the manufacturer's electrical drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Manual. Prepare operation and maintenance manuals. Submit one manual for review; then submit the remainder (quantity to be agreed between owner and contractor in advance). Include one copy of the following:
1. Copy of all relevant, and previously reviewed shop drawings, with all comments addressed.
 2. Record (as-built) drawings, incorporating all field changes and Engineer's comments.
 3. Wiring diagrams incorporating all field changes and Engineer's comments.
 4. Manufacturer's instructions on care, operation, and maintenance of equipment.
 5. Narrative describing the procedures for equipment startup and operation.
 6. Warranty certificates.
 7. Spare parts list.
 8. Complete type written operating instructions, covering all systems descriptions and operation, emergency operating instructions, and precautions.
 9. Copies and originals of all applicable software certificates showing proof of ownership by the Owner's Representative.
 10. Name, address, and telephone number of supplier or representative of manufacturer for each item of equipment in Contract.

Bind all items (all unused, clean and legible) in common folder or heavy notebook covers and submit to Engineer before request for final acceptance. Provide electronic copy in a format agreed to in advance.

- B. Affidavit of Compliance. The manufacturer shall provide an affidavit stating compliance of their equipment with all applicable provisions of this specification.
- C. Software. Submit two electronic copies of all final application software developed. Electronic copy shall be on flash drives, or other method mutually agreed upon between Engineer and Contractor. In addition to electronic copies, submit hard copy of all application software developed. For software applications of a graphical nature (such as Operator Interface Terminals or Human Machine Interfaces), hard copy submittal shall include copies of all screens.
- D. Setup Parameters. Submit printed copy of all setup parameters used for all equipment in this project. This includes, but is not limited to, all setup parameters used for the programmable

controller, the operator interface terminal, the radio, and the variable frequency drive. Include the factory default value of each parameter in this list of setup parameters.

1.5 QUALITY ASSURANCE

- A. Experience: All equipment furnished under Division 26 shall be furnished by manufacturers who have at least three years' experience in the design, production, assembly, and field service of equipment of like type and size. Products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the two-year period. Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests, is furnished.
- B. Uniformity: Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.
- C. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with NEMA, IEEE, or other applicable technical standards and shall have a neat and finished appearance.
- D. Installation: Erect equipment in a neat and workmanlike manner; align, level, and adjust for satisfactory operation. Install equipment so that parts are easily accessible for inspection, operation, maintenance, and repair. Minor deviations from the indicated arrangements may be made, but only after obtaining approval from the Engineer.
- E. Electrical work shall meet or exceed the latest revisions for the following standards and codes except where more stringent requirements have been specified:
 - 1. Local Building Codes
 - 2. National Fire Protection Associations – NFPA
 - 3. National Electrical Code – NEC
 - 4. Underwriters Laboratories, Inc. – UL
 - 5. National Electrical Manufacturers Association – NEMA
 - 6. Institute of Electrical and Electronic Engineers – IEEE
 - 7. American Society of Testing Materials – ASTM
 - 8. Insulated Power Cable Engineers Association – IPCEA
 - 9. Association of Edison Illuminating Companies – AEIC
 - 10. American National Standard Institute - ANSI
- F. In general, all electrical equipment furnished shall be listed and labeled by Underwriters Laboratories, Inc. (UL), Factory Mutual (FM), Edison Testing Laboratories (ETL), or another nationally recognized testing laboratory acceptable to the County and the Engineer. Submit name of organization that will label the equipment, product, or component. Organization shall certify that the equipment meets applicable UL, ANSI, and NEMA standards.

1.6 INSPECTIONS

- A. The Contractor shall have all electrical work inspected by the following agency and this work shall pass such inspection: Independent electrical inspection agency approved by the Engineer.
- B. The Contractor shall furnish to the Engineer a certificate of compliance stating that the completed installation complies with the requirements of the National Electrical Code. This certificate shall be completed by the approved independent electrical inspection agency.

1.7 CONTRACT DRAWINGS

- A. Locations Approximate. The locations of equipment shown on the Contract Drawings are approximate only. The Contractor shall determine the exact locations of the equipment, box-outs, sleeves, and of similar items required for the coordination of electrical work with the mechanical and other work.
- B. Plan Drawings Diagrammatic. Power and Control Plans, and Lighting, Receptacle Circuit & Grounding Plans shown are diagrammatic and functional only and are not intended to show exact conduit layouts, number of fittings, or other installation details. The final determination as to routing, location, and termination shall be governed by structural conditions, obstructions, job conditions, and best industry practices. This shall not be construed to mean that the design of the system may be changed without written approval. The Contractor shall obtain shop drawings affecting all conduit locations before installation. The Contractor shall consult all drawings and specifications which may affect location of any outlet, piece of equipment, or conduit run to avoid interference with other trades. The Contractor shall furnish all labor and materials necessary to install and place in satisfactory operation all power, control, and other electrical systems shown.
- C. Elementary Circuit Drawings and Control Panel Drawings Diagrammatic. Circuit diagrams and elementaries shown are diagrammatic and functional only and are not intended to show exact wiring, circuitry, or to be considered a substitute for wiring diagrams. Control Panel drawings, including sub-panel layout drawings, are diagrammatic and functional only and are not intended to show exact parts and locations, or to be considered a substitute for assembly drawings. The Contractor shall submit shop drawings detailing exact part selection, placement, and wiring connections.
- D. Parts lists and part numbers are included to convey design intent using actual manufactured parts. Every attempt has been made to provide a part number that may be used to order and purchase parts; but the Contractor shall be responsible for checking all part numbers to verify that all parts will perform the intended function correctly as part of an integrated system, and fit in the designated space.

1.8 CONTINUITY OF SERVICES

- A. When existing buildings are in use during construction operations, keep all existing electrical systems in operation within all rooms of buildings at all times.
- B. Provide necessary and temporary connections and relocations as required to maintain existing systems in operation.

1.9 INSTRUCTION OF OWNER'S REPRESENTATIVES

Before request for final acceptance of Work, furnish necessary skilled personnel to operate all systems. Instruct designated Owner's representative in proper operation and care of systems and equipment. Repeat instructions as required.

1.10 PROTECTED WORK

- A. Dry Locations. Dry locations are not normally subject to dampness or wetness. An area classified as dry may be temporarily subject to dampness or wetness.
- B. Wet Locations. Wet locations are areas outside, underground, in concrete slabs or masonry in direct contact with the earth, and areas subject to saturation with water or other liquids, such as a vehicle washing area and unprotected areas exposed to weather.
- C. Classified locations. In areas designated as hazardous locations and where explosion-proof equipment and work is shown or specified, all work shall meet the requirements of the National Electrical Code for Class I, Group D, Division 1 or Division 2 locations as applicable and indicated, unless otherwise noted.
- D. Corrosive Areas. Corrosive areas are areas where the potential exists for corrosive gases or liquids to come in contact and corrode equipment and materials. Corrosive Areas shall include rooms housing chemical storage tanks or chemical feed equipment or pumps.

1.11 REMOVALS AND REPLACEMENT OF WORK

- A. All equipment and materials shown to be removed on the Contract Drawings shall become property of the Contractor and shall be removed off-site unless otherwise noted.
- B. Open conduits not used shall be capped. Spare and unused conductors shall be taped and identified at both ends.
- C. It shall be the responsibility of the Contractor to perform field verification of the existing wiring associated with the Work prior to removal of existing work and installation of new work at the existing facilities. The Contractor shall notify the Engineer prior to conducting field investigation. If discrepancies arise between the power distribution wiring connections indicated on the Contract Drawings and what is field verified, the Contractor shall immediately bring this to the attention of the Engineer.
- D. Where electrical equipment is removed or relocated, also remove all wiring back to source panelboard, MCC, switch or to last remaining device on the same circuit. Associated conduits, hangers, supports, etc. shall be removed unless otherwise noted or required to maintain the support and operation of remaining equipment.
- E. Remove all extraneous wires and exposed conduits for all mechanical, and electrical devices to be removed or abandoned.
- F. Wires shown for removal which are in underground duct banks, or embedded conduit shall be removed unless otherwise noted.
- G. Contractor shall disconnect and remove related equipment and conduit mounting hardware, equipment mounting racks, and equipment associated with materials to be removed unless otherwise required to maintain the support and operation of remaining equipment. Repair all

subsequent unused wall penetrations water-tight. Repair, patch, and paint wall surfaces to match surrounding conditions.

- H. Any conduit abandoned in concrete slabs, walls, or other inaccessible locations shall be left empty except for a nylon pull wire. Ends shall be capped with push plugs for future use.
- I. If cables cannot be removed due to a collapsed or deformed duct, or other similar reason, cut cable at duct entrance at each end and tag cable as "Abandoned Cable", "collapsed duct" or similar text. Notify the Owner of these conditions.
- J. Deliver on the premises where directed, existing material and equipment which is removed and desired by the Owner or is indicated to remain on the property of the Owner.
- K. All instrumentation equipment designated for removal shall be turned over to the Owner regardless if equipment is specifically shown or scheduled. This shall include all flow and level elements, and associated transmitters and/or electronic units.
- L. Equipment and materials not indicated for relocation, reuse, or salvage shall become the property of the Contractor and shall be removed by the Contractor from the premises and disposed of.

1.12 EQUIPMENT RELOCATIONS AND MODIFICATIONS

- A. Relocate equipment and conduits as shown on the Contract Drawings. Provide materials and hardware for patching, plugging, and refurbishing equipment intended for reuse. Provide new nameplates for reused electrical work. Perform all work and make necessary modifications to existing work as required to leave completed system in a finished and workmanlike condition.
- B. Ensure that all hardware items and replacement equipment are on hand prior to performing any demolition, modification, or remedial work.
- C. It shall be the responsibility of the Contractor to perform field verification of the existing conditions associated with the Work prior to removal of existing work and installation of new work. If discrepancies arise between the Contract Drawings and conditions verified in the field, the Contractor shall immediately bring this to the attention of the Engineer.
- D. Equipment, conduits, cables, and materials that are abandoned in place shall be provided with tags, labels, and nameplates indicating "Spare Equipment" or similar text.
- E. Contractor shall take necessary precautions to insure against damage to existing materials or equipment to remain in place, to be reused or to remain the property of the Owner. Repair or replace damaged materials and equipment at no additional cost to the Owner.
- F. Reroute conduits and lighting fixtures where shown on the Contract Drawings and as necessitated by architectural, mechanical, and HVAC changes and for new electrical work.
- G. Provide materials, and hardware for patching, plugging, and refurbishing equipment intended for reuse. Provide new nameplates for reused electrical work.
- H. Where the work specified herein or under other divisions necessitates relocation of existing equipment, foundations, conduits, wiring, etc., perform all work and make necessary

modifications to existing work as required to leave the completed system in a finished and workmanlike condition.

- I. Modify existing motor control centers as required to install new motor starter and feeder circuit breaker equipment as shown on the Contract Drawings.
- J. Modify existing control panels as shown on the Contract Drawings.
- K. Rehabilitate and relocate items of equipment as required and as indicated on the Contract Drawings or specified.
- L. Fill and patch penetrations, holes, damaged surfaces, and similar areas to restore a smooth finish to floors, ceilings and walls. Finish shall match existing, pre-project conditions.
- M. Keep existing electrical system in operation during the progress of work. Provide temporary electrical connections to systems or equipment where necessary to maintain continuous operation until the new systems and equipment are ready for operation.
- N. Contractor shall develop a schedule for power outages that are necessary to execute the work. Schedules shall be reviewed by Engineer and Owner and subject to change based on limitations required to maintain equipment essential to the plant operation and to minimize the effect of the outages on plant operation. This may require working outside normal working hours when removing or installing equipment which will cause a partial or complete shutdown.
- O. When the work specified connects new equipment to any existing equipment, conduit, wiring, or similar object, perform necessary alterations, cuttings, fittings, etc. of the existing equipment as required to make connections between the new and existing equipment or material. The work to the existing and new equipment shall be performed in a workmanlike manner and shall be provided in a finished condition.

1.13 GROUNDING

- A. Equipment and systems shall be bonded and grounded in accordance with Article 250 of the National Electrical Code, applicable local codes, the electrical utility provider, and the manufacturer's recommendations.
- B. Ground raceways and noncurrent carrying parts of electrical equipment in accordance with NEC Article 250. Use the metallic conduit system for equipment and enclosure grounding. Grounding through the conduit system shall be in excess of any equipment grounding conductors shown on the Contract Drawings.
- C. Circuits in nonmetallic conduit shall carry one equipment grounding conductor for equipment grounding.
- D. All metallic equipment, such as tanks, machinery, and piping shall be bonded and grounded.
- E. Equipment and systems shall be bonded and grounded in accordance with 27.9 of NFPA 30.

PART 2 PRODUCTS

2.1 CONCRETE EQUIPMENT PADS (CEP)

Provide concrete equipment pads where shown on the Contract Drawings for setting motor control centers, VFD control panels, transformers, control panels, and other floor and ground mounted equipment, as well as equipment mounting racks. Concrete shall be 4500 PSI, 28 day minimum. Refer to details on electrical drawings for outdoor and indoor concrete equipment pads.

Concrete shall be MDOT SHA Mix #6.

2.2 EQUIPMENT MOUNTING RACKS (EMR)

- A. Equipment mounting racks shall be provided as required to mount and support equipment and where specifically shown on the Contract Drawing details.
- B. The details shown on the Contract Drawings provide minimum requirements for the equipment mounting racks. Equipment mounting racks shall be designed to support the required equipment. Equipment mounting racks shall be constructed to maintain a rigid installation minimizing movement and racking.
- C. Materials
 - 1. Tubing: 2" x 2" x 1/4" Aluminum Alloy (6063-T52)
 - 2. Backplate: 1/4" thick aluminum plate (up to 24" x 24" maximum)
3/8" thick aluminum plate (for sizes larger than 24" x 24")
 - 3. Bottom Plate: 6" x 6" x 1/2" Aluminum Alloy
 - 4. Hardware: 3/8" stainless steel locknuts, bolts, and washers.
 - 5. Alternatively, Thomas & Betts Kindorf channel system, with stainless steel hardware, and non-corrosive parts.
- D. Assembly
 - 1. Corners and angles shall be ground smooth and shall be free of burrs.
 - 2. Equipment mounting racks shall be constructed as required to accommodate field conditions such as handrails, mounting against walls, or other structures.
 - 3. Equipment mounting racks installed on unpaved surfaces or grass areas shall be provided with a concrete equipment pad. The concrete equipment pad shall extend a minimum of 6" around the perimeter of the equipment and an additional 30" (minimum) in front of the equipment to provide an area for operators to stand.
 - 4. Equipment mounting racks shall be sized to facilitate access to the equipment controls. Controls shall be accessible in an area between 42" and 60" above finished grade.
 - 5. Utilize 3/8" full welds as appropriate for the connection of the components.
- E. Equipment Mounting Racks installed in rooms or areas designated as "Corrosive Areas" shall be constructed of non-metallic or stainless steel components. Hardware shall also be non-metallic, stainless steel, or other material resistive to corrosion.

2.3 RUBBER MATS

- A. Provide rubber mats conforming to ASTM D-178 Type I, Class I. Mats shall be at least 30" wide and shall have a length at least equal to the panelboard, motor control center, or control panel before which they are to be placed.
- B. Mats shall be provided in front of all electrical equipment furnished under this Contract, including panelboards, motor starter enclosures, motor control centers, variable frequency drives, equipment control panels, instrument control panels, disconnect switches, automatic transfer switches and switchgear assemblies.
- C. Furnish 2 spare mats, each 8 feet long.

PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

- A. Factory Applied. Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test.
- B. Field Applied. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.2 NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two stainless steel sheet-metal screws or two stainless steel rivets.

3.3 COORDINATION

The Contractor shall coordinate all electrical work involving existing circuits and operations with the Owner for required shutdowns, conversions, and tie-ins.

**** End of Section ****

SECTION 26 05 01
CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Section includes wires, cables, and accessories as shown, specified, or required for the complete power, lighting, control, and other systems in the Contract.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code (NEC)
- B. NFPA 262 – Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- C. Insulated Cable Engineers Association (ICEA)
- D. Underwriters Laboratories, Inc. (UL)
- E. National Electrical Manufacturers Association (NEMA)
- F. American Society of Testing Materials (ASTM)
- G. Association of Edison Illuminating Companies (AEIC)

1.3 SYSTEM DESCRIPTION

- A. Product Requirements. Provide products as follows:
- 1. Conductors for feeders and branch circuits 10 AWG and smaller shall be stranded.
 - 2. Control circuits shall utilize stranded conductors.
 - 3. Conductors for power and lighting circuits shall not be smaller than 12 AWG.
 - 4. Conductors for control circuits shall not be less than 16 AWG.
 - 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 2.5%.
- B. Wiring Methods. Provide the following wiring methods:
- 1. Concealed Dry Interior Locations: Use only building wire, type THHN/THWN, or XHHW insulation in raceway (rigid metal conduit, intermediate metal conduit, or electrical metallic tubing), or nonmetallic-sheathed cable or armored cable.
 - 2. Exposed Dry Interior Locations: Use only building wire, type THHN/THWN, or XHHW insulation in rigid metal conduit.
 - 3. Above Accessible Ceilings: Use only building wire, type THHN/THWN, or XHHW insulation in raceway (rigid metal conduit, intermediate metal conduit, or electrical metallic tubing), or nonmetallic-sheathed cable or armored cable.
 - 4. Wet or Damp Interior Locations: Use only building wire, type THHN/THWN, XHHW, or RHW-2 insulation using raceway (PVC coated rigid metal conduit or rigid metal conduit), direct burial cable, armored cable, or metal clad cable.
 - 5. Exterior Locations: Use only building wire, type THHN/THWN, XHHW, or RHW-2 insulation using raceway (PVC coated rigid metal conduit or rigid metal conduit), direct burial cable, service-entrance cable, armored cable, or metal clad cable.
 - 6. Underground Locations: Use only building wire, type THHN/THWN, XHHW, or RHW-2 insulation using raceway (PVC coated rigid metal conduit or rigid metal conduit), direct burial cable, armored cable, or metal clad cable.

7. Conductors for electrical services shall be in accordance with the National Electrical Safety Code and recommended practices of BGE.

1.4 SUBMITTALS

- A. Prior to obtaining any material in connection with this Section, detailed shop drawings on all material shall be submitted. Submittals shall conform to the requirements given in Section 26 00 00 Electrical General.
- B. Submittals shall contain a material list with manufacturer data describing the material and showing its compliance with the specification, associated standards, and test requirements.
- C. Other Submittals
 1. Samples of any material shall be submitted upon the Engineer's request.
 2. A list of all test equipment shall be submitted to the Engineer for review.
 3. Cable testing results.
- D. For fiber optic cable, submit (in addition to the above requirements):
 1. Catalog data on the testing equipment.
 2. Complete factory test results for each cable reel stating the signal loss for each fiber in the cable.

1.5 CLOSEOUT SUBMITTALS

Provide project record documents which record actual locations of components and circuits.

1.6 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 1. National Electrical Code (NEC)
 2. National Electrical Safety Code (NESC)
 3. Insulated Cable Engineers Association (ICEA)
 4. Underwriters Laboratories, Inc. (UL)
 5. National Electrical Manufacturers Association (NEMA)
 6. American Society of Testing Materials (ASTM)
 7. Association of Edison Illuminating Companies (AEIC)
- B. Conductor Manufacturers. All wires and cables of like type shall be the product of one manufacturer.
- C. Manufacturer Test Requirements. Certified test reports showing compliance with applicable ICEA and UL Standards for each type of conductor shall be provided upon request.
- D. In general, all electrical equipment furnished shall be listed and labeled by Underwriters Laboratories, Inc. (UL) or another organization acceptable to the County and the Engineer.

Submit name of organization that will label equipment if other than Underwriters Laboratories. Organization shall certify that the equipment meets applicable UL, ANSI, and NEMA standards.

- E. Verify that field measurements are as indicated on the drawings.
- F. Coordination. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 PRODUCT

2.1 GENERAL

- A. Unless otherwise shown or specified, all conductors shall be stranded copper.
- B. Material construction of copper conductor strands shall be coated or uncoated soft drawn or annealed copper.

2.2 LOW VOLTAGE CONDUCTORS

- A. Low voltage conductors for 600 VAC service and below shall be rated a minimum of 600 volts. Conductors shall be constructed of uncoated Class B copper concentric-lay- stranded wires, rated for 90 degrees C (dry), 75 degrees C (wet), machine tool wire with thermoplastic (PVC) insulation and nylon jacket. Conductors shall be oil and gasoline resistant II. Conductors stranded in other than Class B may be used provided that all terminals, lugs, and connectors are listed and marked for use with that conductor stranding.
- B. Conductors shall be of the following type, temperature rating, insulation, and/or jacket:
 - 1. THHN/THWN/MTW: 600 Volt, 90°C (dry), 75°C (wet)
 - 2. MTW/AWM: 600 Volt, 90°C (dry) with PVC insulation
- B. Control conductors shall be type MTW/ATM, 14, 16 or 18 AWG. Control conductors for AC circuits within MCC or control panels shall be red. Control conductors energized from a source external to the control panel source shall be yellow.
 - 1. Control conductors may be 16 AWG copper provided all of the following conditions are met:
 - a. Continuous load does not exceed 8 amperes.
 - b. Overcurrent protection is provided by one of the following:
 - i) Branch-circuit-rated circuit breakers listed and marked for use with 16 AWG copper wire and meeting the requirements of Article 240.7 of the National Electrical Code.
 - ii) Branch-circuit-rated fuses listed and marked for use with 16 AWG copper wire.
 - iii) Class CC, Class J, or Class T fuses.
 - 2. Control conductors may be 18 AWG copper provided all of the following conditions are met:
 - a. Continuous load does not exceed 5.6 amperes.
 - b. Overcurrent protection is provided by one of the following:
 - i) Branch-circuit-rated circuit breakers listed and marked for use with 18 AWG copper wire
 - ii) Branch-circuit-rated fuses listed and marked for use with 18 AWG copper wire.

iii) Class CC, Class J, or Class T fuses.

- C. Acceptable manufacturers: Royal, Deceron, Rome, GE, General Cable, Essex, Southwire Company, American Insulated Wire Corp., General Cable Corporation, or equal.

2.3 SUBMERSIBLE CABLES

- A. Submersible pump cable or submersible pump conductors shall be of the extra heavy usage type and be constructed of Class K or H tinned, copper bunch-stranded wires. Insulation shall be EPD with a single pass of CP for Size No. 8 and larger. Cable shall be suitable for use in municipal sewage.
- B. Acceptable manufacturers: Royal, equal.

2.4 INSTRUMENTATION CABLES

- A. Multi-conductor control cable shall consist of 600 volt, individual conductors, each constructed of a minimum of seven strands of No. 14 AWG (or as shown on the Contract Drawings) uncoated Class B copper concentric-lay-stranded wires. Each conductor shall have HMW-PE insulation and color coded PVC outer jacket. Additional overall PVC jacket shall be provided around individual conductors. Cables shall be Type 20-10 as manufactured by Anaconda, Type CT-B manufactured by Rome Cable Co. or equal.
- B. Twisted Shielded Pair (TSP) Instrumentation conductors shall consist of two twisted strands of No. 16 AWG (or as shown on the Contract Drawings) tinned coated Class C copper concentric-lay-stranded wires with a braid or foil shield. Each conductor shall have polyethylene insulation and color coded (black/white) PVC outer jacket. With multi-conductor twisted pair assemblies, each pair shall include individual shield and an overall shield shall be applied over the cable assembly with an additional overall PVC jacket around the conductors.
- C. Acceptable manufacturers: Rome, Deceron, Belden, or equal.

2.5 GROUNDING SYSTEM CONDUCTORS

Grounding grid system conductors shall be constructed of tin coated copper concentrically lay-stranded wires in accordance Section 26 05 26 Electrical Grounding.

2.6 NETWORKING CABLES

- A. Category 5e Cables (CAT 5 enhanced)
1. The cable and patch cords shall consist of four (4) unshielded twisted pair of 24 AWG stranded or solid copper conductors and shall be FEP Teflon insulated. The conductor shall be color coded and the cable plenum jacketed.
 2. The Unshielded Twisted Pair (UTP) wiring shall be able to accommodate data transmission speeds up to 1000 Mbps (gigabit Ethernet) at 100 MHz.
 3. Manufacturer: Belden or equal.

B. Category 6 Cables

1. The cable and patch cords shall consist of four (4) unshielded twisted pair of 24 AWG solid bare copper conductors and shall be FEP Teflon insulated. The conductor shall be color coded and the cable plenum jacketed.
2. The Unshielded Twisted Pair (UTP) wiring shall be able to accommodate data transmission speeds up to 10 gigabits at 250 MHz.
3. Manufacturer: Belden or equal.

B. Coaxial Cable

1. Cable shall be #20 AWG tinned stranded copper with tinned copper braid shielding, and a foam FEP Teflon insulation. Cable shall be rated for 120V, 75°C. Cable shall support Ethernet and shall be plenum jacketed.
2. Video Cable (RG6)
 - a. The conductor shall be #18AWG, 0.037" diameter solid bare copper. The insulation shall be made of foam polyethylene and the core shall have a nominal outside diameter of 0.180 inches.
 - b. There shall be two (2) bare copper braids 98% shield coverage and the cable jacket shall be made of black PVC.
3. Manufacturer: Belden or equal.

2.7 TELEPHONE CABLES

- A. Telephone cable shall be twisted shielded pairs, #24 AWG, and shall be solid copper. Cable shall consist of 4 pairs or 25 pairs as shown on the Contract Drawings. Cable shall be suitable for installation in cable tray, conduit, access floors, and above suspended ceilings.
- B. The cable shall be provided with a FEP Teflon insulation and shall be plenum jacketed.
- C. Manufacturer: Belden or equal.

2.8 FIRE ALARM CABLES

- A. Cable shall be power limited fire protective signaling circuit type meeting the requirements of NFPA 70, Article 760 for Power-Limited Fire Alarm Circuits.
- B. Cable shall be #14 AWG, solid bare copper, shielded.
- C. Cable shall be provided with a red PVC jacket along its entire length.
- D. Manufacturer: Belden or equal.

2.9 FIBER OPTIC CABLE

- A. Fiber optic cable shall be multiple fiber cable, specifically designed for industrial applications. Cable shall be gel filled, loose tube construction suitable for installation outdoors, in duct

banks, or in wet locations. Cable shall be compatible with fiber optic modems provided for the project.

B. Cable Construction

1. Fiber optic cable shall be provided with a double jacket with high tensile strength. Jacket shall be corrosion, oil, chemical, moisture, abrasion, and UV sunlight resistant and shall meet the requirements of the Vertical Wire Flame Test specified by IEEE-383, and UL1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords. Cable shall be rated to operate in temperatures between -40°C to +80°C and a relative humidity of 0% to 100%.
2. Cable shall be provided with an internal rip cord and kevlar strength members.

C. Fiber Characteristics

Type:	Multimode
Core/Cladding Size:	62.5/125 microns
Maximum attenuation:	3.75 dB/km at 850 nm
Minimum bandwidth:	160 mHZ-km at 850 nm
Numerical Aperture:	0.275
Number of fibers per cable:	6

- D. Cable shall be type EXP (extended performance, industrial construction) as manufactured by Phoenix Digital or equal.

E. Fiber Optic Connectors

1. Fiber optic cable shall be provided with all required connectors, couplers, and termination kits as required to provide a working system as specified herein and shown on the Contract Drawings.
2. The connectors shall be completely compatible with the fiber optic cable provided for on this project.

2.10 FLEXIBLE CORD

Flexible cord for conductors 600 VAC and below shall be rated a minimum of 600 volts. Conductors shall be constructed of Class K flexible stranded conductors for sizes 18 AWG through 10 AWG, and soft-drawn rope lay conductors for sizes 8 AWG through 2 AWG, and heat and moisture resistant thermoplastic-elastomer (TPE) insulation, type SEOW.

2.11 COLOR CODING OF CONDUCTORS

- A. Power conductors on systems 600 volts and less shall be color coded in accordance with the following:

1. 480/277 VAC, three phase, 4 wire, 60 Hz.

Phase A	Brown
Phase B	Orange
Phase C	Yellow

	Neutral	White
	Ground	Green
2.	240/120 VAC, single phase, 3 wire, 60 Hz.	
	Conductor 1	Black
	Conductor 2	Red
	Neutral	White
	Ground	Green
4.	208/120 VAC, three phase, 4 wire, 60 Hz.	
	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Neutral	White
	Ground	Green

- B. For conductors larger than No. 6 AWG, colored tape may be used to color code the conductors at all terminations, splices or other places where they are visible.
- C. Multi-conductor Instrumentation cables shall be color-coded according to ICEA/NEMA, latest edition, Method 1.

2.12 CONNECTORS AND TERMINALS

A. Connectors (for #10 AWG and smaller)

- 1. Solderless pressure connectors (wrenuts) for pigtail splicing all power conductors and cables #10 AWG and smaller shall be "Wing-nut" type made by Ideal.

<u>Model No.</u>	<u>Wire Size</u>
451	2 #18 min.; 3 #12 max.
452	2 #14 min.; 4 #12 max.
453	1 #10, and 1 #12 min.; 2 #8 and 1 #16 max.
455	3 #12 min.; 4 #10 max.

- 2. Connectors for (straight) splicing signal and control wires #10 AWG and smaller shall be solderless and compression type. Connectors shall be Burndy Hydent, Thomas and Betts Stakon, or equal.

B. Connectors (for #8 AWG and larger)

- 1. Connections of conductors to terminal posts or other conductors shall be made with UL approved compression type connectors. Wire nuts shall not be permitted.
- 2. Connections shall insure a thorough connection without damaging the conductor.

3. Connections shall be suitable for the conductor size used.
4. Typical compression type fittings shall be as specified below:
 - a. Two way splices for large conductors size 1/0 and larger shall be uninsulated indenture type similar to Burndy "Hy-Link", Thomas and Betts Sta-kon, Burndy, or equal.
 - b. Two way splices for small conductors, size 1 AWG and smaller shall be uninsulated indenture type similar to Burndy "Hy-Dent", Thomas and Betts "Sta-Kon" or equal.
 - c. Fixture connections shall be two piece indenture type similar to Thomas and Betts "Sta-Kon" Series PT-66M, Ideal - Crimp Connector Sleeve No. 410 with wire cap insulated or equal.

C. Terminals

1. Terminals shall be 600 volt, indenture type, two or one hole lugs similar to Thomas and Betts "Sta-Kon", Burndy "Hylug" or equal.
2. Spade terminals shall be locking, vinyl self insulated similar to Thomas and Betts "Sta-Kon", Burndy or equal.
3. All accessories that use special tools for proper application as recommended by the manufacturer shall be installed only with those tools and in accordance with the established practices and recommendations of the manufacturers.

D. Terminal Blocks

1. Terminal blocks shall be suitable for a continuous rating of 600 VAC shall be manufactured in accordance with UL and NEMA standards for clearance between adjacent terminals.
2. Terminal blocks shall be sectional units of molded thermoplastic polyester and suitable for channel mounting.
 - a. Sections shall have built in marking areas
 - b. Center post in each section shall prevent over insertion of wires.
 - c. Sections shall not be interlocked so that one section may be removed without disturbing the remainder of the assembly.
 - d. Terminals shall be tin plated, box lugs, having hardware recessed into the molding, or flat terminal connectors.

E. Power Distribution Terminal Blocks

1. Power distribution blocks shall be constructed of copper. Blocks shall have a minimum of two line connections and one load connection per pole with lug wire range suitable for conductor size as indicated on the Contract Drawings.
2. Power terminal blocks shall be furnished with removable clear lexan cover plates to prevent accidental contact with live parts.

3. Power distribution blocks shall be as manufactured by Allen-Bradley, Gould-Shawmut, or equal.

2.13 MISCELLANEOUS ACCESSORIES

- A. Wire pulling lubricant shall be non-toxic and contain no solvents that degrades wire insulation, plastic tape, or conduits. Lubricant shall not leave residual material in conduit, shall be rust inhibited, and be non-combustible. Lubricant shall be as manufactured by Ideal, Tomic Electric, or equal.
- B. Cable and wire supports shall be Kellem grips or cable supports wedges as manufactured by O. Z. Gedney, or equal.
- C. Cable tags for coding of individual conductors shall be in accordance with Section 26 05 53 Identification for Electrical Systems.
- D. Plastic tape shall be all weather vinyl electrical tape having a high dielectric strength and resistant to sun, water, oil, acids and corrosive chemicals. Tape shall be 3M Type 88 or similar item as manufactured by Bishop Electric, General Electric, Okonite, or equal.
- E. Electrical insulation putty shall be rubber based elastic putty in tape form. Putty shall be 3M Scotchfill, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Unless otherwise shown or specified, all power, lighting, and control circuits shall be enclosed in conduit wireways.
- B. All individual conductors shall be identified at all termination and splice points. Wire numbers or letter coding shall be by means of printed plastic tape, and shall be as scheduled on the Contract Drawings.
- C. Each conductor's insulation shall be a single color throughout its entire length.
- D. Splices and connections shall be made with solderless pressure type connectors, and shall be taped and covered to provide an insulating value of the connection equal to the adjacent wire insulation.
- E. Conductors installed in wireways shall be grouped and bundled as they exit each conduit run. In open areas, such as wireways, manholes, or other similar areas, wires and cables shall be tied every twelve (12) inches.
- F. All conductors shall be carefully handled to avoid kinks or damage to its insulation.
 1. Lubricant may be used to assist in pulling conductors through conduits.
 2. Pulling strain shall not exceed the value recommended by the cable manufacturer.

- G. Spare conductors shall be of sufficient length for future connections where spare terminals are provided; proper terminals shall be installed and connected.
- H. Conductors shall be installed in junction boxes and pull boxes that are sized to meet the requirements of the National Electrical Code for wire bending and minimum radius.

3.2 SPLICES AND JOINTING

- A. Cables and conductors installed in the underground distribution system and duct banks shall be routed continuously from termination point to termination point. No splices shall be made in underground manholes or handholes without written approval by the Engineer. Where underground or outdoor splices of 600 volt conductors are approved by the Engineer, they shall be installed utilizing an epoxy based cast splice kit. Splice kit shall be as manufactured by 3M or equal.
- B. Splices shall be made in junction boxes and shall be taped to an insulating value at least equal to the insulating value of the conductors.
- C. Application of taped joints shall be as follows:
 - 1. For 480/277 VAC power circuits, connection shall be wrapped with plastic tape.
 - 2. For lighting circuits, splice connections shall be wrapped with plastic electrical tape.
 - 3. For motor circuit terminations, splice connections shall be wrapped with 3M Scotchfill tape and finished with plastic tape.
- D. Copper to aluminum connections shall be made with UL approved aluminum-to-copper connectors and compound.
- E. Solder joints, hinged connectors, and bolted terminal lugs will not be permitted. The exception of multi-bolted directed compression connectors in large wire and cable sizes will be permitted, if compression type fittings are not available.
- F. Splices, taps, or terminations shall not be made when conductor ends have missing strands or when the ends are mutilated in any way.
- G. Pump power and control cables shall be connected to conductors using power terminal blocks which shall be mounted inside local junction boxes as shown on the Contract Drawings. Terminal blocks shall be provided with insulation barriers so that there are no exposed live parts inside the junction box.

3.3 MULTI-CONDUCTOR CONTROL CABLE

- A. Multi-conductor cable shall be provided where shown on the Contract Drawings. Multi-conductor control cable may be used where separate control circuits having a number of conductors greater than three are shown on the Contract Drawings. The Contractor shall be responsible for sizing the conduit required at no cost to the Owner.
- B. Termination of cable shall be as specified.

3.4 LOW VOLTAGE AND CONTROL CONDUCTORS

All power, control, and lighting conductors shall be type THHN-90C, THWN-75C/MTW unless otherwise noted.

3.5 CONNECTIONS TO EQUIPMENT

- A. Connections and interconnections shall be made to all equipment in accordance with the Contract Drawings, and wiring diagrams furnished by manufacturers, and as specified by the Engineer.
- B. The Contractor shall be responsible for the accuracy of the connected work made under this contract. Any damage resulting from erroneous connections shall be corrected by the Contractor at his own expense.

3.6 TESTING

A. General

- 1. When all wires and cables are in place but before the final connections have been made, they shall be tested.
- 2. Manufacturer's data on testing resistance shall be submitted with tabulated test results.
- 3. Contractor shall furnish all necessary test equipment instruments.
- 4. All tests shall be performed in the presence of the Engineer, unless waived by the Engineer.
- 5. Contractor shall notify the Engineer three (3) working days in advance of any testing.
- 6. If damage is indicated during testing or upon review of the tabulated data, Contractor shall replace defective wires and cables and retest at no cost to the Owner.

B. Direct Current High Potential Test

- 1. A direct current high potential test (Hi Pot Test) shall be performed as described below for the following conductors:
 - a. All conductors operating over 600 volts.
 - b. Any conductor, not otherwise required to be tested, but in the opinion of the Engineer has been subjected to possible damage.
- 2. The direct current high potential test shall be recorded at one minute intervals over a ten minute period for each conductor, and between each conductor and ground.
- 3. The ten minute period shall commence when the charging/leakage current stabilizes.
- 4. If leakage current stabilizes and decreases with time, the conductor being tested is acceptable.

5. Voltage levels for high potential test shall be as scheduled below.

<u>Rated cable voltage</u>	<u>D.C. high potential test voltage</u>
600	2000
Up to 5 kV	25 kV
Up to 8 kV	35 kV
Up to 15 kV	55 kV
Up to 25 kV	80 kV
Up to 28 kV	85 kV
Up to 35 kV	100 kV

6. The data recorded during high potential testing shall be tabulated by the Contractor and submitted to the Engineer in the typewritten form as indicated below:

High Potential Test Data

Circuit No.	Minute	Test Voltage		
		MF – 1/25 kV	P – 1/2 kV	P – 3/2 kV
PH A, B, C to Grd.	Init.			
	1			
	2			
	...			
	10			
PH A to B, C	Init.			
	1			
	2			
	...			
	10			
PH C to A, B	Init.			
	1			
	2			
	...			
	10			

C. Megaohm Test

- For all wires and cable #8 AWG and larger, a 1500 volt insulation resistance (Megohm) test shall be performed.
- The Megohm test shall be performed on the following combination of conductors:

- a. Between all conductors in the same enclosure
 - b. Between each conductor and ground.
 - c. The resistance test shall be recorded at the end of one minute of sustained voltage.
- D. Acceptance. After all final connections have been made, the equipment and controls shall be tested, by operation, to demonstrate performance.

**** End of Section ****

SECTION 26 05 26
ELECTRICAL GROUNDING

PART 1 GENERAL

1.1 SUMMARY

- A. This section includes rod electrodes, active electrodes, equipment grounding conductors, grounding well components, mechanical connectors, exothermic connections, the grounding system, and the grounding grid where shown on the Contract Drawings.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers
 - 1. IEEE 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 2. IEEE 1100 – Recommended Practice for Powering and Grounding Electronic Equipment
- B. International Electrical Testing Association
 - 1. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- C. National Fire Protection Association
 - 1. NFPA 70 – National Electrical Code
 - 2. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages
 - 3. NFPA 99 – Standard for Health Care Facilities

1.3 SYSTEM DESCRIPTION

- A. The Grounding systems shall use the following elements as grounding electrodes:
 - 1. Existing or new metal underground water pipe
 - 2. Metal building frame
 - 3. Concrete-encased electrode
 - 4. Ground ring
 - 5. Rod electrode
 - 6. Plate electrode

All of these metal underground systems and structures shall be bonded together to form the grounding electrode system. Piping systems and underground tanks shall be included when present.

1.4 SUBMITTALS

- A. Prior to obtaining any material in connection with this Section, detailed shop drawings on all material shall be submitted including but not limited to:
 - 1. Ground Grid Conductors

2. Grid Connecting Conductors
 3. Grid Compression Connectors (each type)
 4. Compression Tools
 5. Grounding Electrodes
 6. Ground Bushings
 7. Water Pipe Ground Connectors
- B. Test Reports: Indicate overall resistance to ground and the resistance to ground at each electrode.
- C. Submittals shall conform to the requirements given in Section 26 00 00 Electrical General.
- D. Submittals shall contain a material list with manufacturer data describing the material and showing its compliance with specifications, associated standards, and test requirements.
- E. Prior to installation of any material, a detailed plan layout of the entire grounding system, including location and quantity of electrodes, connections, and cables shall be submitted to the Engineer for review.
- F. Samples of any material shall be submitted upon Engineer's request.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and grounding electrodes.

1.6 QUALITY ASSURANCE

- A. Materials and installation shall be in accordance with latest revisions of the following codes, standard, and specifications, except where more stringent requirements have been specified herein:
1. National Electrical Code (NEC)
 2. Underwriters Laboratories, Inc. (UL)
- B. These Specifications require that all grounding and grounding circuitry equal or exceed the requirements of the National Electrical Code Article 250, and in the event of a conflict or discrepancy between these Specifications, the Contract Documents, and NEC Article 250, the more stringent requirements shall apply.

1.7 COORDINATION

- A. Complete grounding and bonding of building reinforcing steel prior to concrete placement.

PART 2 PRODUCT

2.1 GROUNDING GRID SYSTEM CONDUCTORS

- A. Grid connecting conductors shall be minimum size 4/0 AWG bare stranded copper conductors in accordance with NEC Article 250.

- B. Grounding grid conductors shall be minimum size 4/0 AWG bare stranded copper conductors in accordance with NEC Article 250.

2.2 GROUNDING ELECTRODES

- A. Rods shall be 5/8 inch in diameter, minimum 8 feet long unless otherwise shown, steel core with copper molten welded or electrolytically bonded to exterior. Two section ground rods are acceptable. Rods shall be manufactured by Copperweld Steel Co., Thompson Lightning Protection, Inc. or equal.
- B. Grounding plates shall be 24 inch by 24 inch, 1/4 inch thick solid copper.

2.3 GRID CONDUCTOR CONNECTORS

Connections shall be made with compression type connectors specially made for buried grounding systems as manufactured by Thomas & Betts Co., Burndy Corp. or equal.

Connections shall be made using an exothermic welding process or irreversible compression connectors.

2.4 EQUIPMENT GROUNDING CONDUCTORS

- A. Equipment grounding conductors shall be in accordance with Section 26 05 01 Conductors and Cables for low voltage conductors.
 - 1. Ground conductor #8 and smaller shall be green in color.
 - 2. For #6 and larger ground conductors, black wire may be used and identified where exposed in all junction boxes, disconnect switches, panels, etc. with green tape wrapped over its entire exposed length.
- B. All exposed grounding conductors such as bars, straps, cables, flexible jumpers, braids, shunts, etc., shall be bare copper.
- C. All submersible pump installations shall be in accordance with NEC Article 250-112 (l and m). Submersible pumps shall include either a grounding conductor integral with the pump power cable or a separate grounding conductor sized in accordance with the National Electrical Code. A connection shall also be made between this grounding conductor and the metallic well casing (if any). This grounding conductor shall terminate at the branch circuit.

PART 3 EXECUTION

3.1 GENERAL

- A. All grounding and bonding of electrical installations shall be in accordance with, or shall exceed the requirements of Article 250 of the National Electrical Code. In the event of a conflict or a discrepancy between these Specifications, the Contract Document Drawings, and the National Electrical Code, the more stringent requirement shall apply.

- B. All metallic equipment, such as tanks, machinery, and piping where the potential exists for an ignitable mixture to be present shall be bonded and grounded.
- C. Ground raceways and noncurrent carrying parts of electrical equipment in accordance with NEC Article 250. Use the metallic conduit system for equipment and enclosure grounding. Grounding through the conduit system shall be in excess of any ground conductors shown on the Contract Drawings.
- D. Circuits in conduit shall carry one equipment grounding conductor for bonding equipment to the grounding system.

3.2 INSTALLATION

- A. Install in accordance with IEEE 142 or IEEE 1100 as applicable.
- B. Install grounding rod electrodes at locations as indicated on the drawings. Install additional rod electrodes to achieve specified resistance to ground.
- C. Install grounding and bonding conductors concealed from view.
- D. Install grounding well pipe with cover at rod locations as indicated on the drawings. Install well pipe top flush with finished grade.
- E. Install grounding electrode conductor and connect to reinforcing steel in concrete pad, generator enclosure, all electrical equipment enclosures, equipment mounting racks, fence, ground rods, and ground test wells.
- F. Install grounding electrode conductor and connect to reinforcing steel in foundation footing.
- G. Bond together metal siding not attached to grounded structure; bond to ground.
- H. Bond together reinforcing steel and metal accessories in pool and fountain structures.
- I. Install ground grid under access floors. Construct grid of 4 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.
- J. Bond together each metallic raceway, pipe, duct, and other metal object entering space under access floors. Bond to underfloor ground grid. Install 2 AWG bare copper bonding conductor.
- K. Install isolated grounding conductor for circuits supplying electronic cash registers, personal computers, and other similar items in accordance with IEEE 1100.
- L. Install grounding and bonding in patient care areas to meet the requirements of NFPA 99.
- M. Equipment Grounding Conductor. Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- N. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

- O. Permanently ground entire light and power system in accordance with the National Electrical Code, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, ground terminals, and ground bus at service panel.
- P. Bare copper bars, cables, fittings, etc. shall not be installed in cinder fill nor shall be covered with soil containing cinders or other corrosive material.
- Q. Cables shall be installed with enough slack to prevent breaking stresses.
- R. All grounding conductors subject to mechanical damage shall be protected by rigid steel conduit or other suitable guards and in all cases where so protected shall be permanently and effectively grounded to said enclosure at each end of its lengths with approved grounding connector and conduit fittings.
- S. Where grounding conductors pass through floor slabs, walls, etc., and are not encased in metal conduit, they shall be sleeved in transite, fiber, or approved nonmetallic conduit.
- T. Connections to water pipes, including water meter or other similar device bypass connections, shall be made only after the surface of the pipe at the point of connection has been thoroughly cleaned and brightened and immediately prior to actually making the connection the contact surfaces are to be coated with Vaseline or Oxidation Preventive Compound.
- W. All equipment ground bus, ground pads, frames, enclosures, etc., shall have all surfaces at the point of connection thoroughly cleaned and brightened, to remove paint or non-conducting material, just prior to actually making the connection. Touch-up damaged pointed surfaces to match existing conditions.
- X. Splices in wire or cable grounding conductors are prohibited.

3.3 GROUNDING GRID SYSTEM

A. Grounding Grid

1. Where shown on the Contract Drawings, a system of grounding conductors and driven electrodes, known as the grounding grid shall be installed. The grounding grid shall interconnect all the various grounding systems.
2. The grounding grid conductors shall be embedded in a minimum of 36 inches below the finished grade and 36 inches from the foundation walls or footings in the backfill material around the structure(s).
3. All underground conductors shall be laid slack.
4. Where shown on the Contract Drawings the Contractor shall locate the existing ground grid and make connections thereto.
5. Locations shown for the existing ground grid are approximate only and the exact location shall be determined in the field.

7. Care shall be taken in locating the existing grid to avoid damage to existing power and control conduits.

B. Grounding Electrodes

1. The grounding electrodes shall be driven as located on the Contract Drawings.
2. In areas where rock is encountered or hard ground makes the driving of grounding electrodes impractical, copper plates shall be installed in lieu of the grounding electrodes. The Contractor shall notify the Engineer in writing of his intention to substitute the copper plate in lieu of the electrodes.
3. Installation shall be a minimum of 36 inches below grade and 36 inches from footings.

C. Grid Connecting Conductors

1. In addition to the grounding requirements of the National Electrical Code, a grid connecting conductor shall be provided for, but not limited to, the following equipment:
 - a. All transformer frames
 - b. Neutral transformer taps
 - c. Frames of electric motors 10 HP and larger
 - d. Exposed structural steel
 - e. Grounding of the conduit system
 - f. Service entrance disconnects
 - g. Motor control centers, including enclosure and ground bus
 - h. Switchgear and switchboard including enclosures and ground bus
 - i. Plant water system point of connection to each building or structure, if provided
 - j. Engine generator sets
2. Where any equipment is shown or specified as “future,” sufficient lengths of the grounding conductor, connected to the ground grid, shall be installed for future connections.
3. The ground grid connecting conductors shall be connected to the grounding grid, and all shall be buried in or below the floor slab with no conduit enclosures, unless exposed to mechanical injury.

3.4 GROUNDING SYSTEM CONNECTIONS

- A. Exposed connections shall be made with pressure clamps. Connections between different metals shall be protected against corrosion and moisture with an insulating epoxy resin.
- B. Buried connections shall be made with exothermic weld type connections. Exothermic welding equipment shall be selected and used in accordance with the equipment manufacturer’s instructions. Equipment and molds shall be used to accommodate the wire size, the metallic structure’s shape, the wire position of attachment, vertical or horizontal, and other criteria that may be specified. Before a mold is used, remove and clean slag, dirt, and other foreign matter from the mold. Use cartridge and charge size based on the manufacturer’s recommendations for the specific application. Different charges are required for steel and ductile iron pipe.

1. Surface preparation

- a. Surfaces with little or no coating shall be cleaned to bare metal by grinding or filing an area approximately three inches square to produce a bright metal surface. Weld area shall be free of coating, dirt, mill scale, oxide, grease, moisture, and other foreign matter.
 - b. Surfaces with a thick coating shall have a four inch square window cut through the coating and three inches square of surface cleaned to bright metal. Avoid damaging the surrounding coating.
2. Prior to welding, remove the wire insulation as required to fit the mold. Avoid damaging the exposed copper wire. If the wire is cut or nicked over half way through its diameter, cut off and strip a new end. If the manufacturer requires the use of a copper sleeve, the sleeve shall be crimped securely to the wire and excess wire protruding from the end of the sleeve removed.
3. After the charge is set, remove the mold and slag from the weld area with a welder's hammer. Strike the top and sides of the weld with the hammer to test the secureness of the connection. If the weld does not hold, remove the scrap weld material clean and begin the weld process again.
4. After the weld is completed and prior to coating the clean and weld area, the Engineer may test the joint bond wire for electrical continuity.

5. Weld Caps

- a. After the weld passes the test for soundness, and electrical continuity, repair coating in the weld area with a cold-applied bituminous or coal-tar mastic and a weld cap placed over the weld. Mastic shall be applied to fill the weld cap and cove the exposed metal of the structure and the wire to a minimum thickness of 1/4 inch. Damage to the coating around the weld area shall be repaired according to the coating manufacturer's recommendations.
- b. If weld cap will not fit due to physical space limitations, coat bare metal and wire in weld area with a minimum 1/4 inch thickness of bituminous mastic.

C. In fixtures, enclosures, equipment, etc., ground terminals or lugs shall be provided.

1. Ground clips may be installed within device or switchboxes where terminals are not provided or are impracticable if used with solid ground wire.
2. Each panel, switchboard, or motor control center shall be provided with a ground bar of sufficient size for all ground conductors to be connected.

3.5 CONDUIT SYSTEM

A. Ground Conductor

1. All power and 120-volt control system conduits (feeders, branch circuits, lighting circuits, etc.) shall have an internal equipment grounding conductor, which shall be sized in accordance with the requirements of the National Electrical Code. This equipment grounding

conductor shall be installed although it may not be shown or scheduled on the Contract Drawings.

2. The equipment grounding conductor shall be bonded to each device box, pull-box, junction box, or wiring trough it passes through.
3. All conduits one inch and larger shall be provided with grounding bushings on each end and at all cabinets and pull, junction, or outlet boxes.
4. The Contractor shall exercise care to ensure good ground continuity, in particular, between the conduit system and equipment frames and enclosures.
5. Circuits in conduit shall carry one equipment grounding conductor for bonding equipment to the grounding system.
6. Ground raceways and noncurrent carrying parts of electrical equipment in accordance with NEC Article 250. Use the metallic conduit system for equipment and enclosure grounding. Grounding through the conduit system shall be in excess of any ground conductors shown on the Contract Drawings.

3.6 SECONDARY ELECTRICAL SYSTEM

- A. The neutral conductor of all low-voltage, single and/or polyphase distribution systems shall be solidly connected at one point only. This connection shall be as follows:
 1. For Separately Derived System
 - a. Ground neutral at transformer neutral bushing. Connect to system ground and transformer enclosure in accordance with NEC Article 250. In addition, Transformer secondary neutral bushings are also to be bonded to nearest metallic water pipe, building steel, or ground rod.
 - b. Control power transformers must have their secondary (neutral) leg grounded at the transformer.
 2. For Subfed Secondary Systems: Neutral shall be grounded only at one point of origin of secondary systems. Do not ground subfed panel neutral bars. Ground connection shall be in accordance with NEC Article 250.
 3. For Service Supplied Systems
 - a. The electric service shall be grounded at an accessible point in the main service disconnect in accordance with NEC Article 250.
 - b. The grounding conductor shall be sized in accordance with NEC, Table 250-66 unless otherwise shown or specified.

3.7 TESTING

- A. Acceptance

1. Unless otherwise specified, the installed grounding grid shall have a resistance to ground of 5 ohms or less.
2. The Contractor shall test all grounding conductors and grounding systems for continuity. Where continuity does not exist, jumpers shall be installed at no cost to the Owner and the system retested.
3. All testing shall be performed in the presence of the Engineer.

B. Grounding Resistance

Grounding resistance of the existing facility ground grid shall be tested using the ratio method, or other similar method that is acceptable to the Engineer. Contractor shall submit test procedure and equipment to be used in the testing. If the grounding resistance of the existing facility ground grid is in excess of 5 ohms, additional grounding shall be provided. After installation of additional grounding, ground resistance shall be retested to verify that the value does not exceed 5 ohms.

****End of Section****

SECTION 26 05 33
CONDUITS AND RACEWAY SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

This Section includes the conduit system required, specified, or shown on Contract Drawings including conduits, fittings, boxes, hangers, and accessories.

1.2 REFERENCES

- A. American National Standards Institute
 - 1. ANSI C80.1 – Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 – Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 – Aluminum Rigid Conduit – (ARC).
- B. Underwriters Laboratories
 - 1. ANSI/UL 6 – Electrical Rigid Metal Conduit – Steel
 - 2. UL651A – High Density Polyethylene (HDPE) Condit
 - 3. UL 1990 – Nonmetallic Underground HDPE Conduit with Conductors
- C. National Electrical Manufacturers Association
 - 1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FN 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 – Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2- Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 – Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 – PVC fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceways and boxes located as indicated on the drawings, and other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground More Than 5 Feet Outside Foundation Wall: Provide rigid metal conduit, PVC coated rigid metal conduit, or concrete encased PVC conduit. Provide cast metal boxes or nonmetallic handhole.
- C. Underground Within 5 Feet from Foundation Wall: Provide rigid metal conduit, PVC coated rigid metal conduit, or concrete encased PVC conduit. Provide cast metal or nonmetallic boxes.
- D. In or Under Slab or Grade: Provide rigid metal conduit, PVC coated rigid metal conduit, or concrete encased PVC conduit. Provide cast metal or nonmetallic boxes.

- E. Outdoor Locations, Above Grade: Provide rigid metal conduit or PVC coated rigid metal conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- F. In Slab Above Grade: Provide rigid metal conduit or PVC coated rigid metal conduit. Provide cast metal boxes.
- G. Below Grade: Provide Schedule 40 or Schedule 80 PVC conduit in concrete encased duct bank where indicated on the drawings.
- H. Wet and Damp Locations: Provide rigid metal conduit or PVC coated rigid metal conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounted outlet boxes in finished areas.
- I. Concealed Dry Locations: Provide rigid metal conduit, PVC coated rigid metal conduit, or PVC conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- J. Exposed Dry Locations: Provide rigid metal conduit, PVC coated rigid metal conduit, or PVC conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 SUBMITTALS

- A. Prior to obtaining any material in connection with this Section, detailed shop drawings on all material shall be submitted. Submittals shall conform to the requirements given in section 26 00 00 Electrical General.
- B. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications and associated standards.
- C. Samples of any material shall be submitted upon Engineer's request.
- D. Prior to installation of any material in a specific area, a detailed plan layout of the conduit system, including the routing of conduits, support systems, junction boxes, conduit fittings and condulets, and coordination of other work, shall be submitted to the Engineer for review. Existing conduits and enclosures to be reused shall be shown and indicated on the submittal.

1.5 CLOSEOUT SUBMITTALS

Provide project record documents which record actual locations of components and circuits.

1.6 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standard Institute (ANSI)
 - 2. National Electrical Code (NEC)
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. Underwriters Laboratories (UL)

- B. Equipment furnished under this section shall be furnished by manufacturers who meet the industry standards for quality, workmanship, and experience.

PART 2 PRODUCT

2.1 CONDUIT

A. Rigid Metal Conduit (Type RMC)

1. Rigid metal conduit shall be galvanized steel, hot-dipped with zinc over the entire length, both exterior and interior including threads. Conduits shall have a coat of lacquer for sealing.
2. Each conduit shall have a coupling on one end and a thread protector on the other. Conduit shall be UL Listed and threaded in accordance with ANSI/ASME B.1.20.1-1983 Pipe Threads, General Purpose (inch) (3/4-inch taper per foot).
3. Conduit shall meet ANSI Standards C80.1 and C80.4 latest revisions, and ANSI/UL6. The conduit shall be manufactured by Allies Tube & Conduit Corporation, Pittsburgh Standard Conduit Company, Triangle PWC Co., or equal.

B. PVC Coated Rigid Metal Conduit

1. PVC coated rigid metal conduit and fittings shall consist of a rigid metal conduit having a PVC coating not less than 40 mils thick. Rigid metal conduit shall be as specified above. PVC coating shall be bonded to the conduit and fittings such that the bonding shall be stronger than the tensile strength of the PVC.
2. PVC coated rigid metal conduit shall be in accordance with NEMA Standard RN-1, latest revision, for Type A-40 PVC coated conduit and fittings. PVC coated conduit and fittings must comply to ASTM D870, D1151, D3359 and D1308.
3. The PVC coated conduit and general purpose fittings must be UL Listed for the PVC as supplying the primary corrosion protection.
4. Fittings and conduit bodies shall be in accordance with NEMA FB1, steel fittings with external PVC coating to match conduit.
5. The conduit threads must be hot galvanized, not hot dipped, and have an additional coat of clear Urethane.
6. PVC coated rigid steel conduit, all conduit bodies, fittings, and female threads shall include a minimum of 2 mils urethane internal coating. Product shall be Robroy Plasti-Bond Red, Perma-Cote or engineered approved equal.

C. Non-Metallic Conduits (PVC)

1. Non-Metallic conduits and fittings shall be Schedule 40 or schedule 80, polyvinyl chloride. Materials shall be corrosion and fire retardant, and sunlight resistant.
2. Conduit and fittings shall be in accordance with the NEMA Standard TC-2 and TC-3, latest revisions, and UL-651 Schedule 40 and 80 PVC Conduit.
3. The conduit and fittings shall be manufactured by Carlon Electric Conduit Co., Triangle PWC Co., or equal.

D. High Density Polyethylene (HDPE) Conduit

1. HDPE conduits and fittings shall be DR26. Materials shall be corrosion and fire retardant and sunlight resistant.
2. Fittings: Molded; ASTM D3261, butt welded.
3. Joints: socket heat fusion or butt fusion.
4. Materials: ASTM D3350, minimum cell classification 324433-C.
5. Manufactured by ISCO Industries, WL Plastics, or approved equivalent.

E. Flexible Conduit

1. Flexible metallic conduit (Greenfield). Shall be hot dipped galvanized flexible steel or aluminum and shall comply with UL Standard No. 1, latest revisions. Conduit shall be manufactured by Anaconda Metal Hose Company, Triangle PWC Co., or equal. Fittings shall be PVC coated at each end of the liquid-tight conduit.
2. Liquid-tight flexible metal conduit (Seal-tight). Shall be constructed of flexible corrosion resistant zinc galvanized steel conduit with an extruded plastic jacket and built-in continuous copper ground strap under the jacket. Conduit shall be type UA manufactured by Anaconda Metal Hose Company, Type LA manufactured by Electri-Flex Co., or equal. Fittings shall be PVC coated at each end of the liquid tight conduit.
3. Liquid-tight Flexible Non-metallic Conduit. Shall be constructed of corrugated flexible PVC. Fittings shall be identified for use with flexible non-metallic conduit. Flexible non-metallic conduit shall be Carflex as manufactured by Carlon, or equal.
4. Hazardous Area Flexible Metal Conduits. Flexible metal conduits installed in areas classified as Hazardous shall be Crouse-Hinds Series EC, Killark Series EK, or equal.

2.2 JUNCTION, DEVICE AND PULL BOXES

A. Junction Boxes.

1. Junction boxes and pull-boxes shall be sized as required for the quantity and size of conductors to be installed within the box. Sizes shall comply with the requirements of the National Electrical Code for wire bending space radius.
2. Stamped Steel Junction Boxes. Stamped steel junction boxes installed in areas approved for use with EMT conduit may be constructed of code-gage galvanized steel.
3. Cast Junction Boxes. Junction boxes for use with RMC shall be constructed of hot-dipped galvanized cast iron or copper free aluminum and shall be sized per NEC requirements. Boxes shall be manufactured by Crouse-Hinds Co., Killark Co., or equal.
4. PVC coated Junction Boxes. Junction boxes used with PVC coated rigid metal conduit shall be hot-dipped galvanized cast iron or copper free aluminum with a minimum of 40 mil factory applied PVC coating and a minimum of 2 mil of factory applied urethane interior coating. Thin or non-coated areas of the interior coating will be cause for rejection. Cover screws or bolts shall be stainless steel. Junction boxes and fittings are to be of the same manufacturer as the PVC coated conduit and must be UL listed with the PVC as a primary corrosion protection. Junction boxes installed in wet locations shall be suitable for such use.

5. Hazardous Area Junction Boxes. Junction boxes in areas classified as Hazardous shall be Series EJB or GU manufactured by Crouse-Hinds Co., Series XB or GR as manufactured by Killark Co., or equal.

B. Device Boxes for Outlets and Switches

1. Stamped Steel Device Boxes. In areas approved for use with EMT Conduit, device boxes may be constructed by code-gage galvanized steel with required knockouts. Boxes shall be manufactured by Steel City Co., or equal.
2. Cast Device Boxes. Cast device boxes shall be constructed of hot-dipped galvanized cast iron or copper free aluminum and sized in accordance with the requirements of the National Electrical Code. Boxes shall be Series FD manufactured by Crouse-Hinds Co., Series FD manufactured by Killark Co., or equal.
3. Flush Device Boxes. Device boxes installed within concrete masonry units shall be constructed of code-gage galvanized steel and shall be of the type specifically approved for masonry use. Boxes shall be installed flush with finished surface and the mounting height shall be adjusted for masonry joints.
4. Hazardous Area Device Boxes. In areas classified as Hazardous, device boxes shall be Series ED manufactured by Crouse-Hinds, series SWB manufactured by Killark Co., or equal.
5. PVC Coated Device Boxes. Device boxes used with PVC coated rigid steel conduit shall be hot-dipped galvanized cast iron or copper free aluminum with a minimum of 40 mil factory applied PVC coating and a minimum of 2 mil urethane interior coating. Thin or non-coated areas in the interior will be cause for rejection. Cover screws shall be stainless steel. PVC coated device boxes and fittings are to be of the same manufacture as the PVC coated conduit and must be UL listed and the PVC coating shall provide the primary corrosion protection.

C. Pull Boxes:

Pull boxes shall be used in dry locations only for pulling. No splicing of conductors shall be allowed. The boxes shall be constructed of galvanized steel, 12-gauge sheet metal, angle and frame members with welded joints. The pull box cover shall be gasketed and attached with stainless steel screws. A ground lug shall be provided, sized in accordance with the National Electrical Code.

2.3 CONDUIT OUTLET BODIES, FITTINGS, COUPLINGS, EXPANSION COUPLINGS, CONDUIT SLEEVES, AND SUPPORTS

A. Conduit Outlet Bodies

1. Conduit outlet bodies shall be used where required to permit ready fishing and withdrawing of wires. Conduit bodies not located in areas classified as Hazardous shall be gasketed. Bodies shall be of cast iron or copper-free aluminum type. Bodies shall be Condulet series manufactured by Crouse-Hinds Co., Electrolet series manufactured by Killark Co., or equal.

2. Conduit bodies used with PVC coated rigid metal conduit shall be of the cast type as specified above with a factory applied 40-mil PVC coating. The conduit bodies, fittings, and couplings shall be provided with extruded PVC sleeves as required by NEMA Standards. Conduit bodies, for general service, (½" – 2") shall be equipped with a V-Seal gasket. All general-purpose fittings must be UL Listed for the PVC coating as supplying the primary corrosion protection, in accordance with the National Electrical Code. All screws shall be stainless steel with the screw heads encapsulated with PVC. Product shall be Robroy "Plasti-Bond Red", Perma-Cote, or engineer approved equal.
3. Conduit outlet bodies used with rigid PVC conduit shall be of the same material and schedule as rigid PVC conduit.

B. Fittings and Couplings

1. PVC Coated Rigid Metal Conduit - All couplings and fittings for PVC coated rigid metal conduits shall have factory coating similar to above PVC coated conduit bodies.
2. PVC - All couplings and fittings for PVC rigid conduit shall be of the same material and schedule as PVC rigid conduit.
3. Hazardous Areas - Seal off fittings in areas classified as Hazardous or Corrosive shall be Series EYS manufactured by Crouse-Hinds Co., Series E manufactured by Killark Co., or equal. Sealing compound shall be Chico manufactured by Crouse-Hinds or Series SC manufactured by Killark, or equal. Damming material shall be of the ceramic fiber type.

C. Expansion Couplings

1. Expansion couplings shall be a watertight, corrosion retardant coupling with flexible neoprene outer jacket, stainless steel jacket clamp, flexible copper ground strap, and internal hub bushing.
2. Coupling shall compensate for the following movements:
 - a. Axial expansion or contraction
 - b. Angular misalignment
 - c. Parallel misalignment
3. Coupling shall be Type XD as manufactured by Crouse-Hinds Company, Type DX as manufactured by O.Z. Gedney Co., or equal.

D. Conduit Sleeves

Where conduits pass through the walls or floors of structures, they shall be installed in suitable sleeves. Sleeves, installed in the outside walls of structures or elsewhere where watertightness is required, shall be cast iron and shall be equal to thru-wall and floor seal manufactured by O.Z. Gedney Manufacturing Company, Inc. Types No. FSK, WSK, FSC, or WSC as required, or Link-Seal as manufactured by Thunderline Corp. When Link-Seal is used, a wall sleeve, with water-stop, shall be installed. All other sleeves shall be galvanized steel pipe.

E. Conduit Hangers and Supports

1. Hangers and supports for conduits shall be adequate to support conduit systems with a minimum safety factor of 10.
2. All steel parts of the conduit support systems shall be galvanized, cadmium plated or PVC coated.
3. Perforated strap hangers shall not be used.
4. Conduit supports shall be as manufactured by Steel Coty Co. (Kindorf), Unistrut Corp., Allied Tube & Conduit Corporation (Power-Strut) or equal.
5. One hole, malleable iron pipe clamps shall be hot-dipped galvanized. Pipe spacers shall be of malleable iron and have a hot-dip galvanized finish.
6. Hanger rods shall be continuous thread and galvanized not less than 3/8" inch in diameter.
7. All fasteners shall be stainless or silicon bronze.
8. All expansion anchors shall be self-drilling type.

F. Cable Terminator Fitting

1. Cable terminating fittings shall be provided complete with gland nut and neoprene bushing properly sized to provide a tight seal.
2. Cable terminator fittings shall be CGB or CGF series as manufactured by Crouse-Hinds, or equal.

2.4 MISCELLANEOUS ACCESSORIES

A. Warning Tape

1. Tape shall be red and have imprinted a minimum of 1-inch high letters "CAUTION BURIED ELECTRIC LINE BELOW" or appropriate warning approved by the Engineer.
2. Tape shall be 6 inches wide, 4.5 mils thick, and made of low-density polyethylene.
3. Warning tape shall be as manufactured by Allen Systems (Houston, Texas), Panduit, or equal.

B. Duct-bank Conduit Spacers

1. Underground Duct-bank conduit spacers shall provide stability and consistent separation on duct-banks. Spacers shall be sized for the conduits with which they are used. They shall provide both vertical and horizontal spacing with interlocking intermediate and base spacers.
2. Duct-bank conduit spacers shall be as manufactured by Carlon, or equal

2.4 SUPPORT GRIPS

Provide a flexible wire mesh holding device to fit around an electrical cable for support of motor cable as shown on the Contract Drawings. The support grip shall support vertical runs of up to 99 feet with loads up to 600 pounds. Provide a single eye for attaching support grip to steel rod. Support grips shall be Hubbel Kellems, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. All interior conduit work shall be installed exposed except areas in which there is a finished ceiling, or as indicated on the Contract Drawings, "Room Finish Schedule," a finished ceiling will be installed. These areas shall have all conduit work concealed.
2. No exterior conduits shall be run exposed on outside walls of buildings, or structures.
3. Minimum size shall be $\frac{3}{4}$ inch unless specifically shown otherwise.
4. Sufficient expansion fittings for the application shall be installed.
5. Conduit shall not be used to support enclosures except as permitted by the National Electrical Code.
6. Splices or taps shall not be made inside conduits.
7. All conductors and neutrals of the same circuit and all equipment grounding conductors shall be contained within the same conduit.
8. The conduit system shall be installed complete, including tightening of joints, from termination point to termination point, prior to installation of conductors.
9. Conduit shall be installed with a minimum number of joints. Conduits shall be continuous and shall be secured in such a manner that each system shall be electrically continuous. Terminations of conduits shall be furnished with locknuts at each fabricated panel using watertight conduit hubs. (Use PVC coated hubs in corrosive or chemical environments).
10. Terminations of metallic conduits shall be furnished with grounding bushings in accordance with Section 26 05 26 Electrical Grounding.
11. Where exposed conduit requires clamping to the building structure, clamps shall consist of galvanized iron or stainless steel one-hole pipe straps and expansion shields.
12. All conduit fittings, connectors and couplings shall be properly tightened in such a manner so as not to be easily "backed off" in order that proper ground continuity is established.

13. The use of lubricating materials to aid in the installation of conductors is allowed. Where necessary, a powdered soapstone and “Y-ER-EAS” are acceptable.
14. Support outlets, pull-boxes, and junction boxes separately from building construction, not from conduit.
15. Where exposed conduit is permitted, install conduit parallel to or perpendicular to walls, ceilings, and lines of building, in neat and organized configurations.
16. Coordinate all conduit installations with other trades in advance of installation.
17. Ream conduit ends before installation
18. Plug conduit openings until wires are installed.
19. Where spare conduits are shown to be installed, the conduit shall be capped at each end as provided with a nylon fish-wire.
20. Expansion couplings shall be installed in conduits crossing building expansion joints.
21. Plug conduit openings until wires are installed
22. Do not install conduit or boxes in structural columns unless detailed on Contract Documents.
23. Do not install adjacent to or on hot surfaces.
24. Do not install conduit in water or in areas saturated with moisture.
25. All conduit threads shall be given a coat of zinc dust in oil or other approved compound and shall be made watertight.
26. All conduits routed next to walls, columns, or ceilings shall have minimum 1/4” separation between conduit and walls or ceiling.
27. Conduit reducers shall not be allowed unless otherwise specified, or approved by the Engineer.
28. Conduits entering enclosures shall be provided with Myers hubs.

B. PVC Coated Rigid Metal Conduit Requirements

1. PVC coated rigid metal conduits shall be installed using proper tools for threading and tightening conduit fittings.
2. Cutting back of coating for threading will not be allowed.
3. Minor touch up of coating shall be with manufacturer’s recommended touch-up compound of applicable color.

4. Contractor must be trained and certified by the factory before installation of PVC coated products can begin.
5. Any coating and conduit considered by the Engineer damaged excessively shall be replaced at Contractor's expense.
6. Conduits shall be installed with a minimum number of joints. Conduits shall be continuous and shall be secured in such a manner that each system shall be electrically continuous. Terminations of conduits shall be furnished with locknuts at each fabricated panel or pull box using PVC coated hubs. Hubs shall be as manufactured by Myers.
7. Conduits entering enclosures shall be provided with PVC coated Myers hubs.

C. PVC Rigid Conduit Requirements

1. PVC rigid conduit shall be installed per manufacturer's recommendations.
2. Use proper tools for installing PVC conduits.
3. Fittings, boxes, and other accessories shall be PVC of the same schedule with all joints being the solvent cement type.

D. Conduit Supports and Hangers

1. Conduit supports shall be spaced at intervals of 8 feet or less as required to obtain rigid construction.
2. Single conduits shall be supported by pipe clamps with clamp backs to raise conduits at least 1 inch from the surface.
3. Multiple runs of conduits shall be supported on trapeze hangers with steel horizontal members and threaded hanger rods. Trapeze hangers shall be crossed braced to prevent spreading.
4. Conduit hangers shall be attached to structural steel by means of beam or channel clamps.
5. Supports located in corrosive areas and/or where shown shall be PVC coated.

E. Conduit Routing

1. The number of bends, offsets and crossovers shall be kept to a minimum.
2. The Contractor shall exercise the necessary precautions to prevent the lodging of dirt, plaster, or foreign matter, in conduits, boxes and fittings during installations.
3. Runs shall be parallel to walls, beams, columns and horizontal planes and shall be neatly aligned.
 - a. For bends made in the field, an approved conduit bending machine shall be used.
 - b. Field bends shall be symmetrical and carefully made so as to prevent damage or deformation of conduit.

4. Conduit runs shall be slightly pitched to facilitate draining condensation or shall be otherwise installed to prevent trapping of condensation.

F. Underground Conduits

1. Conduits shall be buried to a minimum of 24 inches unless otherwise shown or specified.
2. All buried metallic conduits shall be individually tied to plant grounding grid at each electric manhole or handhole.
3. All buried conduits or groups on conduits 2 feet in width or less shall have an identifying tape buried 12 inches under finish grade and located directly over the centerline of the conduits. Groups of conduits over 2 feet wide shall have additional identifying tape per 2 feet or less of additional width. Where shown on the Contract Drawings, additional tapes shall be provided for duct banks wider than thirty inches.
4. Underground conduit not encased in concrete shall be PVC coated rigid steel
5. Underground conduit exiting and entering structures shall have expansion couplings as specified.
6. Where conduit is buried below structures, footing, slabs, etc., the electrical Subcontractor shall excavate, install, backfill, and compact buried conduit prior to final compaction by General Contractor.
7. The transition from the underground conduit system to the building interior conduit system shall occur at the first junction box, device, or equipment enclosure within the building. Conduit seals shall be provided at this location. Such seals shall minimize the circulation of air between the underground conduit system and the indoor enclosures. Seals shall be composed of Duct Seal sealing compound or similar non-hardening removable sealant.
8. Conduit bends in underground conduits shall have a minimum centerline radius as follows:

<u>Conduit Size</u>	<u>Radius (inches)</u>
3 inch	36
4 inch	42
5 inch	48

9. Conduits terminating at manholes shall have endbells or insulated bushings.
10. Conduit spacers shall be used when installing two or more underground conduits. Conduit spacers shall be located at intervals of 8 ft or less.

F. Conduits in Concrete

1. All electrical conduit placed in concrete slabs shall be installed after and above the bottom reinforcing bars, but before and under the top reinforcing bars.

- a. Where conduit crossovers are necessary, they shall be located so that the reinforcing bars are not displaced from their positions.
 - b. The minimum clearance between conduits shall be 2 times the diameter of the conduit.
 - c. No conduit greater than t/4 in diameter, where “t” is the thickness of the concrete slab, shall be placed in any structural slab.
 - d. If these conditions cannot be satisfied, the conduit shall be placed below the slabs.
2. Where electrical conduits in slabs cross a building expansion joint, an expansion coupling for each conduit shall be installed at the joint.
 3. Conduits encased in concrete shall be type 40 heavy - wall polyvinyl chloride per NEMA standards and UL listed.
 4. Where concrete encased conduits enter manholes, #4 dowels shall be installed between the duct bank and manhole, on 8 inch centers around the perimeter of the duct bank, to minimize the potential for conduit shearing at the ductbank/manhole interface.
 5. Concrete encased conduits (underground ductbanks) where shown or scheduled shall be schedule 40 PVC. Where these conduits enter buildings or equipment, concrete encasement shall stop approximately 5 ft from the building or equipment. There shall be a transition from schedule 40 PVC to RMC or IMC approximately 10 ft. from the building or equipment, so that the transition occurs within the concrete encasement.
- G. Conduits in Corrosive Areas. Where conduits pass through Corrosive Area walls and/or floors, seal-off fittings as specified shall be installed to prevent gas leakage through the conduit system.
- H. Conduits in Hazardous Areas. All conduit and equipment, in or through areas classified as Hazardous and all conduit and equipment for explosion proof work, shall be installed in accordance with the provisions of Article 501 of the National Electric Code for Class I, Group D, Division 1 locations. Compound filled seal-off fittings as specified shall be installed as required.

3.2 CONDUIT TYPES

- A. Conduit types shall be in accordance with the following schedule unless specifically noted otherwise on the Contract Documents:

Area/Use Description	RMC	PVC coated RMC	PVC	Reference Notes:
Underground Ductbanks	x	x		
Conduit Encased in Concrete			x	
Exposed Conduit	x			
All conduits in “Corrosive” Areas		x		

- B. Only rigid metal conduit (RMC)), shall be provided, unless specifically noted otherwise on the Contract Drawings.

**** End of Section ****

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

This Section includes materials, procedures, practices, and requirements that shall be provided for identification of raceways, conductors, instruments, equipment, and devices.

1.2 QUALITY ASSURANCE

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. National Electrical Code (NEC)
2. Underwriters Laboratories, Inc. (UL)

1.3 SUBMITTALS

- A. Prior to obtaining any materials in conjunction with this Section, detailed shop drawings on all material shall be submitted. Submittals shall conform to the requirements given in Section 26 00 00 Electrical General.
- B. Submittals include:
1. Complete list of all engraved nameplates. Failure to indicate all nameplates on this list shall not relieve the contractor of the requirement for their installation.
 2. Sample of engraved nameplate, punch type label, marking tags, laminated instrument tags.
 3. Catalog data sheets for engraved nameplates, marking tags, or other item used to identify equipment.
 4. Duplicate set of all engraved nameplates.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Nameplates shall be engraved lamicoid.
- B. All lettering shall be uppercase (condensed block type), unless otherwise noted.
- C. Nameplate colors shall be black with white letters unless otherwise shown.

- D. Nameplate numbering system, lettering style, and letter size shall be as shown on Contract Drawings, schedules, etc.

2.2 MARKING TAGS (WIRE AND CABLE IDENTIFICATION)

Marking Tags shall be by means of preprinted plastic tape. Manufacturer: Brady, O.Z. Gedney, equal.

2.3 INSTRUMENT TAGS

- A. Instrument tags shall be laminated vinyl tape, minimum 3 inches by 5 inches with preprinted insert and "write on" type laminate to provide calibration and servicing information. Each tag shall include a pre-punched hole for fastening to instrument with ty-raps.
- B. Tags shall be Panduit No. PST-2 or equal with a preprinted (not handwritten) insert.
- C. Each instrument tag shall include the following as appropriate:

SIDE 1

FIT – 5021(*instrument tag number*)

FLOW INDICATIONG TRANSMITTER (*instrument type*)

Manufacturer: xxxxx
Model No.: xxxxx
Serial No.: xxxxx
Calibrated Range: xxxxx
Power: 0-24 VDC (*if applicable*)
Installed by: xxxxx, Inc.
Any town, Any state, USA

SIDE 2 (*write-on laminate side*)

FIT – 5021 (*instrument tag number*)

FLOW INDICATING TRANSMITTER (*instrument type*)

Calibrated Range: xxxx-xxxx GPM
Output: 4-20 mA
Alarms Set @ High: xxxxx
 Low: xxxxx
Recommended Service Interval: xxx months
Last Serviced on: xxxxx
Last Serviced by: xxxxx

PART 3 EXECUTION

3.1 INSTALLATION

- A. Follow the numbering systems specified, scheduled and/or shown on the Contract Documents.

- B. Provide identification noted on panel schedules, one-line diagrams, etc. for all instruments, panelboards, contactors, transformers, disconnect switches, bus-ways, motor starters, devices, controllers, motor control centers, unit substation, fire alarm systems, sound systems, and all other electrical devices and enclosures. Indicate with engraved lamicoid nameplate, on cover of equipment and label with numbers and letters as shown.

3.2 FASTENING

- A. Nameplates: Clean equipment surface and securely fasten each label with silicone adhesive.
- B. Instrument Tags: Laminated instrument tags shall be fastened to instruments with cable ties.

3.3 DEVICES (RECEPTACLES AND LIGHT SWITCHES)

Label all receptacles and light switches on faceplate with 3/4-inch clear punched (Dymo) tape.

- A. Provide the following information:
 - 1. Panel Designations (per panelboard schedules)
 - 2. Branch Breaker Number

3.4 WIRE CABLES

- A. Tag all feeders, sub-feeders, special system wiring, and control wiring in each panelboard, pull-box and gutter space, denoting points of origin and termination of the wires.
- B. Provide the following information:
 - 1. Panel or source where the conductors originate
 - 2. Circuit Number
 - 3. Circuit Designation

3.5 EMERGENCY LIGHTING

All lighting fixtures powered from an emergency source of power shall be identified by 1/2-inch diameter red dots.

3.6 SPECIAL PANELBOARD REQUIREMENTS

- A. Nameplates: Identify in accordance with Panel Schedule
- B. Directory:
 - 1. Provide complete type written directory for each panel, with all room numbers, functions, etc., clearly identified for each individual branch circuit.
 - 2. Handwritten directory shall be provided until all circuits are connected and balanced. Then, install permanent directory. Do not mark circuit identification on the front of enclosure of panels or on other electrical equipment.
 - 3. Lighting panel locations shall be identified in the panel directory according to location.
 - 4. Electrical sub-feed circuits from panels shall also be identified in the panel directories.

5. When branch circuits are relocated, the panel directory shall be updated to indicate new functions, and locations.
6. When branch circuits are removed, the panel directory shall be updated to indicate a spare.

**** End of Section ****

SECTION 26 09 00
INSTRUMENTATION

PART 1 GENERAL

1.1 SUMMARY

This Section includes requirements for the complete instrumentation system for this project as shown, specified and as scheduled. Detailed specifications for instrumentation equipment are included herein, on the Contract Drawings, and where specifically referenced elsewhere in the specifications. Unless otherwise noted, this section shall apply to all instrumentation furnished under this project, regardless of whether it is specifically identified in this section.

1.2 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revision of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Underwriters Laboratories (UL)
 - 4. American National Standards Institute (ANSI)
 - 5. The American Society of Mechanical Engineers (ASME)
 - 6. The American Society for Testing Materials (ASTM)
 - 7. Instrument Society of America (ISA)
- B. Qualifications of manufacturer. Provide materials and equipment that are the products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.
- C. Uniformity: Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.
- D. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ISA, ANSI, ASME, ASTM, and other applicable technical standards and shall have neat and finished appearance.

1.3 SUBMITTALS

- A. Submittals shall conform to the requirements of Section 01 33 00 Submittals, and to the requirements given in Section 26 00 00 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference.

- B. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications, associated standards and test requirements.
- C. Submittals for individual pieces of equipment such as indicators, flow meters, level meters, etc. shall include manufacturer's data describing the equipment and showing its compliance with their associated specification.
- D. The Contractor, his supplier, system builder, or subcontractor shall prepare and submit a set of system coordination drawings which shall show all instrument connections and interconnections as well as the functional and connection relationship of the instrumentation equipment to the related equipment and devices.
- E. Prior to obtaining any material in connection with this section, catalog data and detailed wiring connection diagrams shall be submitted. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings, circuit diagrams, and dimensional data, as a minimum. Drawings shall include elementary and interconnection diagrams showing connections to internal components, and indicate field termination points for power and control interface. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted.
- F. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly and section views, and all necessary details pertaining to coordinating the work of the Contract, lists of materials and finishes, parts list and the descriptions thereof, lists of spare parts and tools where such parts or tools are required, and any other information that is required to demonstrate compliance with the Contract Documents. Drawings for electrical equipment shall include elementary and interconnection diagrams showing connections to internal components, and indicating field termination points for power and control interface.
- G. Submit factory calibration sheets for all instrumentation, and field calibration sheets for calibration under actual use conditions.
- H. Manufacturer's standard wiring diagrams and specific modifications to the wiring of the equipment shall be submitted. All terminal points for field, and interconnecting wiring shall be identified.
- I. Samples of any material shall be submitted upon Engineer's request.

1.4 CLOSEOUT SUBMITTALS

- A. Prepare four instruction and maintenance portfolios as specified hereinafter. Each shall include:
 - 1. Index and tabbed section dividers
 - 2. Reviewed submittals
 - 3. Wiring diagrams
 - 4. System coordination drawings
 - 5. Field adjustable settings (e.g. setpoints, ranges, spans current alarm trips)
 - 6. Manufacturer's instructions on care and operation of equipment.
 - 7. Spare parts list

8. Complete typewritten operating instructions, covering all systems descriptions and operation, emergency operating instructions and precautions.
 9. Name, address and telephone number of supplier and representative of manufacturer for each item of equipment in Contract.
- B. Bind above items (all unused, clean, and legible) in three ring binders and submit to Engineer for review. Provide before request for final acceptance.
 - C. Provide project record documents which record actual locations of components and circuits.
 - D. Provide project record documents which record actual setup and calibration of each instrument.

PART 2 PRODUCT

2.1 GENERAL

- A. Unless otherwise specified, each measurement system shall be accurate within one percent of full-scale reading over the specified range. This accuracy requirement shall apply to each overall system including any transmitters, retransmitters, receivers, etc. that are shown or required.
- B. All instrumentation equipment and components shall be supplied by one contractor, subcontractor, supplier or other single entity who shall coordinate the equipment and its arrangements in the shop drawing, installation and start up stages of the work.

2.2 SIGNAL CARRIERS

- A. Signal Carriers for instrumentation shall include the electric wires, cables and conduits as shown, specified and required for a complete transmission of signals between transmitters and receivers.
- B. Electronic instrument signals (4-20mA) shall be carried over shielded twisted pairs of wires in accordance with Section 26 05 01 Conductors and Cables. All electric interconnections and terminations shall be in accordance with the requirements for control wiring specified in Section 26 05 01. Signal conductors shall be separated from power and control conductors and routed in separate conduits, regardless of whether they are specifically scheduled or shown.
- C. Shielded, coaxial, or special cables, where specified or required by the manufacturer, shall be supplied by the contractor regardless of whether they are specifically scheduled or shown.
- D. Current isolators shall be provided and installed where required for proper operation of the equipment.
- E. All instruments which utilize a 4-20 mA analog signal shall include surge/lightning transient protectors at the transmitter's power source. Transient surge protection device shall be Phoenix Contact PLT-SEC-T3-24-FM-UT 2907916.
- F. All 4-20 mA analog control loops containing field mounted (i.e. remote from control panel) transmitters shall include surge/lightning transient protectors at the transmitter. Transient protectors shall be Phoenix Contact TTC-6P-1X2-24DC-PT-I 2906815, or equal.

- G. All 4-20 mA analog control loops containing field mounted (i.e. remote from control panel) transmitters shall include surge/lightning transient protectors at the transmitter. Transient protectors shall be Phoenix Contact TTC-6P-1X2-M-24DC-PT-I 2906750, or equal

2.3 MISCELLANEOUS EQUIPMENT

- A. Enclosures for instruments shall be suitable for the location where mounted.
- B. Isolators. Current to Current (I/I) or Voltage to Voltage (E/I) isolators shall be one of the following:
1. Current to current multi-channel 2-wire isolator; 4-20 mA input, 4-20 mA output – Acromag 600T Series
 2. Input Loop Powered, current to current; 4-20mA input, 4-20mA output- Acromag 270i Isolator or equal
- C. Signal Splitters. Current to current (I/I) or Voltage to current (E/I) signal splitters shall be one of the following:
1. 2 wire type, current to current; single 4-20 mA input, dual 4-20 mA outputs – Acromag 653T, or equal
 2. 2 wire type, process voltage to current; +/- 1VDC, +/- 5VDC, or +/- 10 VDC input, dual 4-20 mA outputs – Acromag SP237, or equal.
 3. 2 wire type, thermocouple to current; thermocouple/millivolt input, dual 4-20 mA control signal outputs – Acromag SP233 or equal.
 4. 2 wire type, high voltage to current; +/-15 VDC, +/- 75 VDC, or +/- 150 VDC input, dual 4-20 mA outputs – Acromag SP230 or equal.
 5. 4 wire type, current to current, single 4-20 mA input, dual 4-20 mA output, AC/DC powered – Acromag 633T, or equal.
- D. Power Supplies. DC power supplies shall be of sufficient size to power all connected equipment with an additional 50% reserve. DC power supplies shall be: Phoenix Contact UNO-PS/1AC/24DC/30W- 2902991, or equal.
- E. Power Disconnection and Overcurrent Protection. Panel mounted instruments shall have integral or external fuse protection. Field instruments shall utilize terminal block mounted fuses.
- F. Signal Conditioner
1. Provide a measurement, control, and regulation device which is capable of receiving a 4-20mA input signal and generating two 4-20mA output signals. Each output signal shall be identical to the input signal and isolated to the input signal and the other output signal.
 2. Performance
Number of inputs: 1
Current input signal: 4 - 20 mA

Input burden: less than 3.0 V (150 ohms) at full scale
Input overvoltage protection: bipolar transient voltage suppressors
Input excitation: 24VDC +/- 10%, 22mA maximum each. Full isolated. Independent current limiting
Output range: 4-20 mA (each channel)
Output trim range: zero to full scale adjustment to +/- 4%
Output limiting: limited to 27 mA
Output load: 0 to 950 ohms
Output load resistance effect: less than +/-0.01% of output span effect for a +/-100 ohm change in load resistance
Output response time (input step change): 25 mSec typical to achieve 98% of final value
Accuracy: +/-0.05% of output span
Temperature drift: > +/-50ppm/ °C over the ambient temperature range
Bandwidth: -3dB at 50Hz
Common Mode Noise Rejection:
Input resistance (current input): 50 ohms

3. Signal output data:
Number of outputs: 2
Voltage output signal: 0 (each identical to the input signal). .

G. Digital Line Powered Meter

1. Provide a Digital Line Powered Meter for any and all instruments that require power from a 24 VDC source. The purpose of the digital Line Powered Meter is to provide a locally mounted power supply for the Level Indicating Transmitter, Pressure Indicating Transmitter, or temperature sensor.
2. Features
 - a. NEMA 4X enclosure / Explosionproof
 - b. Powered using 115/230 VAC (Universal 85-265 VAC input power)
 - c. 4-20mA retransmitted signal from instrument
 - d. 2 (or 4) programmable relay outputs
 - e. User configurable display
 - f. Display: 6 digits 1"
 - g. Provide mounting kit for Digital Line Powered Meter
3. Manufacturer/Model
 - a. Helios PD2-6001-6H7
 - b. Precision Digital Model PD650, 655, or 656 (655-45)
 - c. Precision Digital Model PD6000
 - d. Magnetrol Model 009
 - e. equal

2.4 FLOAT LEVEL SWITCH

- A. Float level switches shall be designed for applications requiring accurate liquid level control, including wastewater environments. Float switch shall be capable of accurately signifying specific water levels, or for direct alarm actuation.

- B. Float switches shall consist of a polypropylene or polyethylene body housing a mechanical type limit switch. Float switch shall be leak proof, shock proof, and impact resistant. Float switch shall also be suitable for use in wastewater applications and for use with intrinsically safe circuits.
- C. Ratings.
- Liquid temperature: minimum 0°C (32°F), maximum 76°C (170°F)
 - Liquid density: minimum 0.65 g/cm³, maximum 1.5g/cm³
 - Degree of Protection: IP68, 20m (65ft)
 - Contact ratings:
 - AC resistive load, 250 volts 10 amperes
 - AC inductive load, 250 volts 3 amperes
 - DC load, 30 volts 5 amperes
- D. Switch Variations
1. Normally Open (N/O). Contacts are open in the hanging position. As the float rises (1" or 5°) above the horizontal position, the contacts shall close.
 2. Normally Closed (N/C). Contacts are closed in the hanging position. As the float rises (1" or 5°) above the horizontal position, the contacts shall open.
 3. Single Pole, double Throw (SPDT). Both normally open and normally closed contact (but not necessarily both) available.
- E. Provide cord weight to facilitate proper operation of float switch.

2.5 LEVEL INDICATING TRANSMITTER

- A. The level probe shall sense the liquid level as a function of the level of submersion. Level probe shall be a twin rod probe, Guided Wave Radar type, and operate based on the technology of TDR (Time Domain Reflectometry).
- B. Level probe shall be capable of measuring the level of Sodium Hypochlorite and Caustic in the tanks indicated on the drawings. Wetted parts shall be compatible with the Sodium Hypochlorite and Caustic.
- C. The level sensor shall consist of stainless steel, twin rod probe, and a solid state electronic unit (transmitter) housed in a NEMA 4X enclosure. Probe will operate in conjunction with a remotely mounted level transmitter (but within 3 feet of the tank) to provide level information, through a 4-20 mA analog signal, to a remote control panel. Probe shall provide a 4-20mA signal proportional to the liquid level in the tank.
- D. Transmitter
- 1. Signal output 4-20 mA
 - 2. Span 6 to 240 inches
 - 3. Resolution Analog 0.01 mA, display 0.1 inch
 - 4. Power 11-28 VDC
(provide locally mounted Digital Line Powered Meter so unit may be powered using 115 VAC)
- E. Performance Requirements
- 1. Linearity <0.1% of probe length
 - 2. Measured error +/-0.1% probe length or 0.1 inch (3mm)
 - 3. Resolution +/-0.1 inch (3mm)

4. Repeatability	<0.1 inch (3mm)
5. Response time	<1 second
6. Operating temperature range	-40° to +175° F (-40° to +80° C)
7. Process dielectric effect	<0.3 inch (8mm) of selected range
8. Humidity	0-99%, non-condensing

F. Manufacturer/Model

1. Magnetrol Model 705 Transmitter and Magnetrol Model 7EB probe
2. equal

G. Schedule

<u>Tag Number</u>	<u>Service</u>	<u>Notes</u>
1) LIT-2	Sodium Hypochlorite Tank Level	1,2
2) LIT-3	Caustic Tank Level	1,2

Application Notes:

1. Calibration range shall be equal to tank maximum usable depth
2. Provide surge protection

2.6 ELECTROMAGNETIC FLOW METER

- A. The magnetic flow meter shall operate on the principle of electromagnetic induction, and shall produce a 4-20mA output signal that is directly proportional and linear to the volumetric flow rate of the liquid flowing through the metering tube.
- B. The metering system shall consist of a metering sensor tube, signal amplifier, the interconnecting wiring, and all necessary appurtenances for a complete monitoring system. Interconnecting wiring and appurtenances shall be as recommended by the manufacturer.
- C. Metering Tube
 1. The metering tube shall be constructed of 316 Stainless Steel, and rated for a standard working pressure of 150 PSI.
 2. The end connections shall be Carbon Steel flanged, in accordance with ANSI B16.5 Class 150 standards.
 3. The insulating liner material shall be made of a hard rubber elastomer suitable for wastewater flow in conformance with manufacturer's recommendation for the intended service.
 4. The detector head metering tube shall include two self-cleaning measuring electrodes.
 5. The detector head shall include a third electrode located in the upper portion of the inside diameter of the flow tube. This electrode shall be used to detect an empty pipe condition when the fluid flow in the flow tube is running partially empty. Empty pipe detection that is not activated until 50% of the pipe is empty is not acceptable.
 6. The electrodes material shall be corrosion resistance Alloy C.

7. The detector head housing shall be constructed of carbon steel, welded at all joints, and rated to meet NEMA 4.
8. In its submersible option, with remote electronics, the detector head housing shall meet NEMA 6P standards including the junction box for remote electrical connections.
9. When installed in non-metallic or internally lined piping, the detector head shall be provided with a pair of stainless steel corrosion resistance grounding rings.

D. Signal Amplifier

1. The signal amplifier shall be microprocessor based, and shall energize the detector coils with a digitally controlled pulsed DC, low excitation frequency.
2. The signal amplifier shall feature a precise signal management software to ensure the capture of up to 60 flow measurement sample points per minute, thus providing an accurate averaging of the process generated signal.
3. The amplifier shall include a non-volatile memory chip capable of storing all programmable data and accumulated Totalizer values in the event of a power interruption.
4. Automatic zero stability, low flow cut-off, empty pipe detection and bi-directional flow measurement shall be provided by the signal amplifier.
5. The amplifier shall include a 4 line, 16 characters, backlit LCD display to display simultaneously the following:
 - a. Flow Rate in selected unit of measure
 - b. Total forward flow in selected unit of measure
 - c. Total reverse flow in selected unit of measure
 - d. Current software revision number
 - e. Error or alarm messages
6. All outputs shall be isolated to 500 volts.
7. The input power supply for the Electromagnetic Flow Meter Amplifier shall be 115 VAC.
8. The signal amplifier housing shall be NEMA 4X.
9. The electromagnetic flow meter amplifier shall be capable of being mounted up to 300 feet from the amplifier.
10. The amplifier shall provide:
 - a. 4-20 mA analog output signal, capable of driving an 800 ohm load
 - b. output relay contact for high and low flow alarms
 - c. output relay contact for an alarm condition

E. System Performance and Calibration

1. The metering system shall achieve an accuracy of $\pm 0.25\%$ of rate over a flow velocity range from 1.0 to 39.4 feet per seconds. The accuracy performance shall be $\pm 0.5\%$ of rate for flow velocities between 0.1 and 1.0 feet per second.

2. The metering system shall be capable of measuring the volumetric flow rate of liquids having an electrical conductivity as low as 5 micromhos/centimeter.
3. The system measuring repeatability shall be 0.1% of full scale.
4. Each meter shall be hydraulically calibrated in a certified testing facility, which utilizes a computerized gravimetric testing method with a measuring uncertainty of 0.1%.
5. Each meter shall be provided with a calibration certificate indicating the measured error (percent deviation) at three different flows, respectively equivalent to 25%, 50% and 75% of the nominal flow for each size.

F. Manufacturers

1. Badger Meter Inc. Magnetoflowmag meter
2. equal

2.7 SUBMERSIBLE LEVEL TRANSDUCER (PRESSURE TRANSDUCER TYPE)

- A. The submersible pressure transducer shall utilize a piezoresistive pressure cell to measure liquid level.
- B. The submersible pressure transducer shall be capable of translating water level in the water tower to a 4-20 mA signal, proportional to water level.
- C. The level sensor shall consist of the pressure transducer to measure the liquid level and an aneroid bellows to compensate for the affects of atmospheric pressure.
- D. Performance Requirements
 1. pressure range 2.3 through 700 ft water; specifically calibrate instrument to measure from elevation -4.0 ft to elevation 0 ft.
 2. proof pressure 1.5 full scale
 3. burst pressure 2.0 full scale
 4. Static accuracy +/- 1.00% full scale output
 5. Resolution +0.0001% F.S.
 6. Wetted materials 316 Stainless Steel
 7. Compensated Temp Range 0 to 50°C
 8. Thermal Error +/-0.05% (max), +/-0.1% from BFSL
 6. Output signal 4-20 mA
 7. Output impedance <10 ohms
 8. Power Supply 9-30 VDC, loop powered
 9. lightning protection

(provide locally mounted Digital Line Powered Meter or power supply so unit may be powered using 115VAC)

F. Specific requirements

1. Material – Stainless Steel
2. Reference Format – vented gage

3. Output – 4 - 20mA
4. Electrical Connection – molded cable seal
5. Lightning Protection – full lightning protection
6. Level Range - 0 ft – 4 ft water column (0 psi – 1.734 psi)
7. Moisture Protection – aneroid bellows
8. Cable Type – polyurethane
9. Cable length – adequate to route from control panel to level sensor, as shown on the drawings
10. Label - ft H₂O

G. Manufacturers

1. KPSI Series 700 (KPSI 700S14A0B001.734000.000C10050B)
2. equal

2.8 PRESSURE INDICATING TRANSMITTER

- A. The pressure indicating transmitter shall be capable of translating pressure to a 4-20mA signal, proportional to pressure.
- B. Pressure sensor shall be capable of measuring the water pressure at the pump discharge as indicated on the drawings.
- C. Performance Requirements
 1. Measurement Range 0-60psi gauge
 2. Accuracy +/-0.1% of calibrated span (up to 100:1 turndown)
 3. Turn down (minimum span) 100:1
 4. Elevation/Suppression -100% to +100%
 5. Process Temperature Range -40° to +260° F (-40° to +130° C)
 6. Electronics temperature limit -4° to +158° F (-20° to +70° C)
 7. Wetted parts 316 stainless steel
 8. Output signal 4-20mA HART
 9. Enclosure NEMA 6/6P or 4X
 10. Power supply 11.5 -45VDC
(provide locally mounted Digital Line Powered Meter so unit may be powered using 115VAC)
 11. Class I Division 2 Groups A-D
- A. Process connection: ½” NPT. Coordinate with the site conditions and verify that the sensor will be compatible with the existing equipment.
- E. Manufacturer/model
 1. Endress & Hauser PMP51-FD21JD1MGFRKJA1
 2. equal

PART 3 EXECUTION

2.2 INSTALLATION

- A. All electronic instruments and systems shall operate on the universal 4-20mA signal system unless otherwise noted and shall be installed in the instrument loop so that the failure or removal of any instrument from the loop, other than primary element or power supply, will not affect the remaining instruments on the loop or the overall integrity of the loop. This shall be accomplished through the use of bias resistors at each receiver.
- B. All instruments shall be installed as shown, specified, directed and recommended by the manufacturers.
- C. The instrument enclosures shall be solidly grounded with a ground conductor as specified in Section 26 05 26 Electrical Grounding.
- D. Instruments shall be factory calibrated to minimize field adjustments and insure proper operation.
- E. Installation: Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation; install so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements may be made, but only after obtaining approval from Engineer. All power and signal (4-20 mA / 1-5 VDC / other) cables shall be kept isolated and installed in separate conduit systems.

2.3 MISCELLANEOUS INSTRUMENTATION

- A. The following items of materials and installation shall also be provided under this Section.
 - 4. Instrument panels complete with all accessories and appurtenances as shown, specified and scheduled.
 - 5. Furnish and install all mounting stands, supports structures, brackets and accessories as required or detailed for the installation of the instruments furnished. Unless otherwise specified or required, supports shall be galvanized steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with ground or water shall be mounted offset from the wall a minimum of ¼-inch.
 - 6. Temporary storage of all instrumentation equipment shall be in a humidity-controlled environment heated to a minimum of 55°F, maximum of 85°F.
 - 7. Isolation of each device on 4-20 mA loops as required to prevent ground loops, with current-to-current isolators.
 - 8. Current to current isolators as required to provide rated outputs into total impedance of each loop.
 - 9. Identification of instrumentation equipment by means of metal tags or durable printed symbols with information regarding manufacturer, serial number, catalog number and model number.

10. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, including repair and touch up painting of panel after installation.

3.3 STARTUP

- A. The services of competent factory trained representatives of the manufacturer who shall supervise the installation, startup, and operation of the equipment; and conduct the field tests.
- B. Field Tests
 1. After installation, instrumentation equipment shall be checked and the required adjustments shall be made by the representatives of the manufacturers.
 2. Equipment shall be field tested in the presence of the Engineer and shall be demonstrated to operate satisfactorily over the specified ranges.
 3. The Contractor shall provide the necessary test equipment and qualified test personnel.
 4. In the event of failure of the field test, the Contractor shall perform the necessary corrections and retest, at his own cost and expense, the equipment as directed by the Engineer.

**** End of Section ****

SECTION 26 09 10
CONTROL PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes requirements for the programmable controller based Control Panel. This Control Panel shall provide local control.
- B. Equipment furnished under this Contract shall be installed in an industrial type environment and powered from an electrical source that may include harmonic distortion, surges, sags, and other electrical noise under normal operating conditions. The Contractor and his suppliers shall verify that all equipment furnished shall function correctly in this noisy electrical environment. If the equipment is found to be unable to operate in this environment, the Contractor and/or his suppliers shall furnish any replacement equipment, surge protection, power line conditioners, UPS, or other equipment required to correct this problem at no additional cost to the owner.
- C. This section also contains Power Line Surge Protectors as shown on the drawings, specified herein, and otherwise required for appropriate equipment including but not limited to control panels, instrument cabinets, instruments, processors, and other equipment susceptible to damage.

1.2 QUALITY ASSURANCE

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. Underwriters Laboratories, Inc. (UL)
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. JIC Standard EGP-1

1.3 SUBMITTALS

- A. Prior to obtaining any material in connection with this Section, detailed shop drawings on all material shall be submitted. Submittals shall conform to the requirements of Section 01 33 00, Submittals.
- B. Submittals shall include:
 - 1. Bill of materials for all components in the panel
 - 2. Catalog data sheets for all components
 - 3. Elevation/layout of panel (front view)
 - 4. Interior sub-panel layout drawings
 - 5. Elementary wiring diagrams (including wire numbers and field connection points)
 - 6. Nameplate list
 - 7. Conduit penetrations
 - 8. Installation and support details

- C. Submittal shall contain the NEMA type designation and manufacturer's data describing the enclosure and showing its compliance with specifications and associated standards.
- D. Submit diagrams detailing the type, speed, setup parameters, and purpose of all communication ports on each piece of equipment in the control panel. Include a diagram detailing the cabling connections between equipment in the control panel and their ultimate destination or source.
- E. Samples of any material shall be submitted upon Engineer's request.
- F. Submittal shall contain a narrative describing the Control Strategy that will be used as the basis of the PLC program at each control panel.
- G. Contractor shall furnish copy of all development programming software packages that will be used to program the PLCs and OITs. The software shall be submitted within 60 days of project closeout.

1.4 CLOSEOUT SUBMITTALS

Provide project record documents which record actual software and equipment configuration.

PART 2 PRODUCT

2.1 GENERAL

- A. A programmable logic controller (PLC) based control system shall be provided to control equipment, generate alarms, collect and transmit data throughout the site, and provide remote monitoring and control capabilities.
- B. The Contractor shall provide a coordinated system. The Contractor shall provide hardware, software, programming, cables, connectors, line drivers, interposing relays, fuses, terminal blocks, power supplies, surge arresters, printed circuit board and graphics drivers, and special controls required to integrate and implement a functional system as specified and shown on the Contract Drawings.
- C. The Control Panel shall be furnished to house a programmable controller and all other related items to form a complete control system. The Control Panel shall include a programmable controller that shall serve as the local controller for the Bio-Solids equipment. The Control Panel shall also include any control relays, timers, power supplies, signal conditioners, surge suppressors, control operators, pilot lights, operator interface terminals, displays, or other equipment necessary to form a complete control system capable of interfacing with the instruments in the well house.
- D. Type 1 Surge Protection Device. Type 1 surge protection shall be provided for each power feed to each control panel. The device shall provide the following Surge Protection Performance Requirements:

- 1. Ambient Conditions:
 - Degree of protection IP22
 - Ambient temperature -40°C to 80°C (-40°F to 176°F)
 - Altitude <2000 m
 - Permissible humidity 5% through 95%

Shock (operation)	30g (half-sine / 11 ms / 3x +/-X, +/-Y, +/-Z)
Vibration (operation)	7.5g (10 – 500 Hz / 2.5 h / X, Y, Z)

2. General:

IEC test classification	test class II
EN type	T2
IEC Power Supply System	TN-S separate protective earth (PE) and neutral (N)
Mode of protection	L-N, L-PE, N-PE
Mounting type	DIN rail: 33 mm

3. Protective circuit:

Nominal voltage U_N	240/415 VAC
Nominal frequency f_N	50 Hz / 60 Hz
Maximum continuous operating voltage U_c (L-PE)	385 VAC
Maximum continuous voltage U_c (N-PE)	358 VAC
Residual current I_{PE}	< 600 μ A
Nominal discharge current I_n (8/20) μ s	40 kA
Maximum discharge current I_{max} (8/20) μ s	80 kA
Short-circuit current rating I_{SCCR}	25 kA

4. UL specifications

SPD Type 1	
Maximum continuous operating voltage	MCOV (L-L) 750 VAC
Maximum continuous operating voltage	MCOV (L-N) 750 VAC
Maximum continuous operating voltage	MCOV (L-G) 385 VAC
Maximum continuous operating voltage	MCOV (N-G) 385 VAC
Nominal voltage	277/480 VAC
Modes of protection	L-L, L-N, L-G, N-G
Power distribution system	480/277 Wye
Nominal frequency	50/60 Hz

5. Standards and regulations: meets IEC 61643-11

6. Control Panel surge protection device shall be Phoenix Contact Type 1 surge protection device – VAL-US-277/80/4+-FM 2910380 (for 480VAC 4-wire and equipment protection ground).

E. Type 3 Surge Protection Device. Type 3 surge protection shall be provided for the 120VAC power at each control panel. The device shall provide the following Surge Protection Performance Requirements:

1. Ambient Conditions:

Degree of protection	IP20
Ambient temperature	-40°C to 80°C (-40°F to 176°F)
Altitude	<2000 m
Permissible humidity	5% through 95%
Shock (operation)	30g (half-sine / 11 ms / 3x +/-X, +/-Y, +/-Z)
Vibration (operation)	5g (10 – 500 Hz / 2.5 h / X, Y, Z)

2. General:

EN type	T2/T3
IEC Power Supply System	TN-S separate protective earth (PE) and neutral (N)
Mode of protection	L-N, L-PE, N-PE

Mounting type	DIN rail; 33 mm
Short-circuit current rating I_{SCCR}	0.25 kA DC(w/o additional backup fuse) 5 kA DC (for 20 A gG / B backup fuse)
Maximum continuous voltage U_C	150 V DC

3. Protective circuit:

Nominal voltage U_N	120 VAC (TN-S or TT)
Nominal frequency f_N	50 Hz / 60 Hz
Maximum continuous voltage U_C (N-PE)	150 VAC
Rated load current I_L	26 A (at 30°C)
Residual current I_{PE}	< 5 uA
Nominal discharge current I_n (8/20) us	5 kA
Standby power consumption P_C	<10.6 mVA (at U_{REF}), <13.5 mVA (at U_C)
Reference test voltage U_{REF}	132 VAC
Maximum discharge current I_{max} (8/20) us	10 kA
Combination Wave U_{OC} (8/20) us	6 kA
Voltage protection level U_p (L-N)	< 0.75 kV (at U_{OC}) and < 0.95 kV (at I_n)
Voltage protection level U_p (L-PE)	< 0.85
Voltage protection level U_p (N-PE)	< 0.85
TOV behavior U_T (L-N)	240 VAC (5 s / withstand mode), 240 VAC (120 min / withstand mode)
TOV behavior U_T (L-PE)	240 VAC (5 s / withstand mode), 240 VAC (120 mins / withstand mode), 1332 VAC (200 ms / safe failure mode)
TOV behavior U_T (N-PE)	1200 VAC (200 ms / safe failure mode)
Response time t_A (L-N)	<25 ns
Response time t_A (L-PE)	<100 ns
Response time t_A (N-PE)	<100 ns
Short-circuit current rating I_{SCCR}	10 kAC

4. UL specifications

SPD Type 2 (Open-Type SPD)	
Maximum continuous operating voltage	MCOV (L-L) 150 VAC, 150 VDC
Nominal voltage	150 VDC
Rated load current I_L	20 A
Modes of protection	L-N, L-G, N-G, (DC+)-(DC-), (DC+)-G, (DC-)-G
Power distribution system	single phase
Nominal frequency	50/60 Hz
Voltage protection rating VPR (L-N)	700V
Voltage protection rating VPR (L-G)	700V
Voltage protection rating VPR (N-G)	900V
Nominal discharge current I_n	5 kA
Short-circuit current rating (SCCR)	10 kA AC, 5 kA DC

5. Standards and regulations: meets IEC 61643-11

6. Surge protection device for 120 VAC shall be Phoenix Contact Type 3 surge protection device – PLT-SEC-T3-120-FM-UT 2907918.

F. Surge Protection Device for 2-wire floating signal circuit. Two wire surge protection shall be provided for sensors which utilize a 4-20 mA current loop. The device shall provide the following Surge Protection Performance Requirements:

1. Ambient Conditions:

Degree of protection	IP20
Ambient temperature	-40°C to 85°C (-40°F to 185°F)
Permissible humidity	5% through 95%
Altitude	<4000 m
Degree of protection	IP20
2. General:

Housing material	PBT
Mounting type	DIN rail: TH 35-7.5mm, two-section divisible module
Direction of action	Line-Line & Line-Signal Ground/Shield
3. Protective circuit:

IEC test classification	C1, C2, C3, D1
Nominal voltage U_N	24 VDC
Max. continuous voltage U_C	30 VDC, 21 VAC
Rated current	600mA (56°C)
Operating effective current I_c at U_c	< 5uA
Residual current I_{PE}	<1uA
Nominal discharge current I_n (8/20) us (line-line)	5kA
Nominal discharge current I_n (8/20) us (line-earth)	5kA
Pulse discharge current I_{imp} (10/350) us (line-line)	0.5kA
Pulse discharge current I_{imp} (10/350) us (line-earth)	0.5kA
Total discharge current I_{total} (8/20) us	10kA
Voltage protection level U_p (line-line)	<200V (C1 – 1 kV/500A), <320 V (C2 – 10kV / 5kA) <50 V (C3 – 25A) <55 V (C3 – 100A)
4. UL specifications

SPD Type 2 (Open-Type SPD)	
Maximum continuous operating voltage	MCOV (L-L) 150 VAC, 150 VDC
Nominal voltage	150 VDC
Rated load current I_L	20 A
Modes of protection	L-N, L-G, N-G, (DC+)-(DC-), (DC+)-G, (DC-)-G
Power distribution system	single phase
Nominal frequency	50/60 Hz
Voltage protection rating VPR (L-N)	700V
Voltage protection rating VPR (L-G)	700V
Voltage protection rating VPR (N-G)	900V
Nominal discharge current I_n	5 kA
Short-circuit current rating (SCCR)	10 kA AC, 5 kA DC
5. Standards and regulations: meets IEC 61643-21 2000
6. Surge protection device for 4-20mA devices shall be Phoenix Contact surge protection device – TTC-6P-1X2-M-24DC-PT-I 2906750.

2.2 ENCLOSURE

- A. Enclosure shall be NEMA 4X. NEMA 4X enclosures shall be water-tight and dust-tight suitable for outdoor installation, protecting enclosed equipment against splashing water, seepage of water, falling or hose-directed water, and severe external condensation. Enclosure shall also be corrosion resistant. NEMA 4X enclosures located outdoors shall be stainless steel or painted fiberglass for enhanced UV protection.
- B. Enclosure Construction
 - 1. Enclosure shall be constructed of a minimum of 12 gauge steel.
 - 2. Seams shall be continuously welded and ground smooth, with no holes or knockouts.
 - 3. Exterior hardware shall be stainless steel.
 - 4. Enclosure shall be provided with gray prime finish over phosphatized surface inside and out with a white enamel interior unless otherwise specified.
- C. Enclosure Door
 - 1. Enclosure shall be provided with front access single door, as required for the enclosure size. Door shall be provided with three point latches operated by a key locking handle. Latch rods shall have rollers to facilitate door closing.
 - 2. Door shall be mounted with continuous piano hinges. A rolled lip around minimum three sides of door shall be provided to prevent dirt and liquid from dropping into the panel when door is open.
 - 3. Door shall be fitted with a neoprene gasket applied with oil resistant adhesive and held in place with stainless steel retaining strips.
 - 4. Provide an interior door swing-out panel. Swing-out panel shall be by the same manufacturer as the enclosure and shall be specifically designed by the manufacturer for this application. Swing-out panel shall provide an area to mount devices (instead of mounting these devices on the exterior door) so that these devices will be afforded a degree of protection from outdoor weather.
- D. Interior Subpanels
 - 1. Interior subpanels shall be constructed of minimum 11 gauge steel finished in white enamel paint. Fasteners, screws, and equipment mounting racks shall be stainless steel.
- E. Enclosure Accessories
 - 1. A print pocket shall be provided on interior face of the enclosure door.
- F. Internal Wiring
 - 1. Terminal blocks for external connections shall be suitable for No. 12 AWG wire, fabricated complete with marking strip, covers, and pressure connectors. Terminal blocks shall be rated

for 30A at 600 VAC unless noted otherwise. An additional 25 percent spare terminals shall be provided.

2. Terminals shall be labeled to agree with identification shown on supplier's submittal drawings. A terminal shall be provided for each conductor of external circuits, plus one ground for each shielded cable. Wires shall be numbered using wire markers. Wire numbers shall agree with terminal numbers, associated with remote equipment wiring designations, as indicated on the submittal drawings.
3. Wiring shall be grouped or cabled and firmly supported in the panel. Plastic wireway, Panduit or equal, shall be used to route wire within the panel. Wireway shall be run in continuous length with snap on covers.

G. Uninterruptible Power Supply

1. The control cabinet shall include an Uninterruptible Power Supply that shall provide for interrupted service in the event of a power failure. The uninterruptible Power Supply shall be transformer isolated and include a built-in battery charger.
2. The Uninterruptible Power Supply and associated hardware shall have the following ratings:
Operating Temperature: 0°C to 40°C (32°F to 104°F)
Humidity: 95% relative (non-condensing)
3. The Uninterruptible Power Supply shall have the following ratings:
 - a. Input Voltage 120VAC
 - b. Output Voltage 120VAC
 - c. Power 1000 Watts, 1440 VA
 - d. Harmonic Distortion <5%
 - e. Waveform Type Sine Wave
4. Uninterruptible Power Supply shall be APC Smart-UPS SMT 1500.

H. Circuit Identification

1. Each circuit shall be identified by a typewritten directory with transparent sealed plastic cover, fastened to the inside surface of the door of the enclosure.
2. Devices mounted on or within the enclosures shall be permanently identified. The device and terminal identifications shall agree with those shown on the Contract Drawings

2.3 PROGRAMMABLE CONTROLLER

A. General

1. The PLC processor and related equipment shall be the product of one manufacturer and the components shall be completely compatible.
2. The PLC processor shall be designed and tested to operate in an industrial, high electrical noise environment. The system shall be provided with RFI protected shields and barriers to prevent interference with other electrical systems.

B. Uninterruptible Power Supply

1. The PLC system shall include an Uninterruptible Power Supply that shall provide for interrupted service by the PLC processor in the event of a power failure. The Uninterruptible Power Supply shall consist of two parts: 1) 24VDC Power Supply Unit and 2) Uninterruptible Power Supply unit containing the energy storage.
2. The 24VDC Power Supply shall have the following performance characteristics:
 - a. Enclosure degree of protection: IP20
 - b. Ambient Temperature: 13°F to 158°F (-25°C to 70°C)
 - c. Humidity: <95% (25°C non-condensing)
 - d. Nominal Input Voltage: 100-240VAC or 110-250 VDC
 - e. Input Voltage Range: 100 -240 VAC (-15% / +10%) or 110-250VDC -18%/+40%
 - f. Frequency range: 50-60 Hz +/- 10%
 - g. Power consumption: 163 VA
 - h. Inrush current: 14A
 - i. Input fuse: 6.3A
 - j. Power factor: 0.82
 - k. Nominal output voltage: 24VDC
 - l. Nominal output current: 5A
 - m. Output power: 120W
 - n. Typical response time: 300msec
 - o. Efficiency: >88%
 - p. Insulation voltage input/output: 4kVAC (type test) and 2kV AC (routine test)

The 24VDC power supply shall be Phoenix Contact QUINT4-PS/1AC/24VDC/5 2904600.

3. The Uninterruptible Power Supply unit shall have the following performance characteristics:
 - a. Enclosure degree of protection: IP20
 - b. Ambient Temperature: 32°F to 104°F (0°C to 40°C)
 - c. Humidity: <95% (25°C non-condensing)
 - d. Input Voltage: 24VDC
 - e. Input Voltage Range: 18 VDC to 30 VDC
 - f. Current consumption (maximum): 9.3A (at 24 VDC)
 - g. Current consumption (idle): 9.7 mA
 - h. Current Consumption (charging process): 1.7A
 - i. Nominal output voltage: 24 VDC
 - j. Nominal output current: 5A
 - k. Power boost: 7.5A
 - l. Efficiency: >97%
 - m. Battery technology: VRLA

The Uninterruptible power supply shall be Phoenix Contact QUINT-UPS/24VDC/24VDC/5/1.3AH 2320254.

C. PLC Processor

1. The PLC shall be a high-performance 32 bit multi-core processor-based, networked controller. The core processor architecture shall be high-speed quad-core. It shall be a process and logic controller designed for industrial environments. It shall be capable of a mix of logic, timing,

counting, and computation functions. It shall also include a library of preprogrammed subroutines, and PID loop control capabilities.

2. The PLC system shall come complete with central processors, memory, communication ports, interconnecting cables, and discrete I/O interfaces.
3. The PLC shall maximize processor efficiency by prioritizing critical tasks. One continuous controller task shall run in the background at the lowest priority, using any remaining CPU time after periodic and event tasks are finished. The system shall support up to 1000 programs across these tasks. Event tasks shall be activated by specific triggers.
Controller tasks – continuous. 32 tasks
 - periodic. 1000 programs/tasks
 - event. All event triggers.
4. Dual Ethernet Port. The PLC shall utilize a dual configurable Ethernet port, capable of one gigabit . The dual Ethernet port shall support device-level ring), linear, or star network topologies. Network topology shall also support use of two IP addresses for network separation between the machine level and the enterprise level.
5. Onboard display. The PLC shall be equipped with an onboard display to allow for immediate visual status of communications, module health, and I/O fault activity.
6. Enhanced Security. The PLC shall utilize digitally signed controller firmware, controller-based change detection and logging, and a three-position mode switch which adds a physical layer of security.
7. USB Port. The PLC shall be equipped with a USB port that can be used for programming, troubleshooting, or firmware updates.
8. Input/output modules. The PLC shall support various modules, including AC/DC digital input/output, high-speed counter, Ethernet/IP adapter, analog input, analog output, relay output, and serial communications.
9. The PLC and associated hardware shall have the following ratings (minimum):
 - Operating Temperature: 0 Deg. C to 60 Deg. C (32 Deg. F to 140 Deg. F)
 - Storage Temperature: -40 Deg. C to 60 Deg. C (-40 Deg. F to 140 Deg. F)
 - Humidity: 5% to 95% relative (non-condensing)
 - Shock: IEC 60068-2-27 (Test Ea, Unpackaged Shock) Operating 30 g
 - Shock: IEC 60068-2-27 (Test Ea, Unpackaged Shock) Nonoperating 50 g
 - Vibration: IEC 60068-2-6 (Test Fc, operating) 5g @ 10...500 Hz
 - Emissions: IEC 61000-6-4
 - ESD immunity: IEC 61000-4-2 6kV contact discharge and 8kv air discharge
 - Radiated RF immunity: IEC 61000-4-3 10 V/m with 1 Hz sine-wave 80% AM from 80-6000 MHz
 - EFT/B immunity: IEC 61000-4-4 +/- 4kV at 5 kHz on power ports, +/- 2kV at 5 kHz on Ethernet ports.
 - Surge transient immunity: IEC 61000-4-5 +/- 1kV line-line (DM) and +/- 2kV line-earth (CM) on power ports, +/- 2kV line-earth (CM) on Ethernet ports.
 - Conducted RF immunity: IEC 61000-4-8 10V rms with 1kHz sine-wave 80% AM from 150kHz – 80MHz
 - Voltage Variation: IEC 61000-4-29 10ms interruption on MOD Power port.

10. PLC Module features and ratings

User Memory:	2MB
Local I/O modules (maximum):	16
Number of power cycles:	80,000
Power voltage range:	18-32 VDC
Power current, max:	450 mA
Power inrush:	850 mA for 125 msec
Power passthrough:	9.55A @ 18-32VDC
Power current rating, max:	10A
Power voltage ranges:	0-32 VDC; 0-240 VAC, 47-63 Hz
Power dissipation, max:	8.5W
Thermal dissipation, max:	29 BTU/hr
Isolation voltage:	50V USB to Ethernet, all others 300V
Weight:	1.693 lb (0.768 kg)
Dimensions:	5.67 x 3.86 x 5.39 inches (143.97 x 98.10 x 136.81 mm)

11. PLC Processor shall be Allen-Bradley Compact Logix 5380.

D. Digital Input Module

1. Where indicated on the Contract Drawings, the PLC system shall include a Digital Input Module. The Digital Input Module shall be capable of reading 16 discrete 120 VAC input points.
2. The Digital Input Module shall have the following ratings:
 - a. Number of digital inputs: 16
 - b. Voltage category: 120/240 VAC
 - c. Input voltage range: 79-264 VAC
 - d. Input voltage frequency: 47-63 Hz
 - e. Mod Power: 75mA @18-32 VDC
 - f. Sensor/Actuator Power: 240mA @ 79-264 VAC
 - g. Sensor/Actuator Power (passthrough): 9.975A @ 79-264 VAC
 - h. Power dissipation, max: 3.5W
 - g. Thermal dissipation, max: 11.9 BTU/hr
 - h. Isolation Voltage: 250VAC (continuous)
 - i. Indicators: 1 green/red module status indicator, 16 yellow/red I/O status indicators
 - j. Input current per channel; (max): 15mA @264 VAC
 - k. On-state voltage, min: 79 VAC min, 120VAC nominal
 - l. On-state current, nominal: 6mA
 - m. Input impedance: 17.6 kohms min, 24 kohms nominal
 - n. Response time: Off to On 1 msec, On to off 10 msec
 - o. Environment: 5% relative humidity – 95% relative humidity non-condensing, -40°C (-40°F) to 60°C (140°F)

4. Digital Input Module shall be Allen-Bradley 5069-IA16

E. Digital Output Module

1. Where indicated on the Contract Drawings, the PLC system shall include a Digital Output Module. The Digital Input Module shall be capable of reading 16 discrete 120 VAC input points.
2. The Digital Input Module shall have the following ratings:

- a. Number of outputs: 16
- b. Voltage category: 120/240 VAC
- c. Output voltage range: 85-264 VAC
- d. Output voltage frequency: 47-63 Hz
- e. Mod Power: 100mA @18-32 VDC
- f. Sensor/Actuator Power: 4 A @ 85-264 VAC
- g. Sensor/Actuator Power (passthrough): 9.975A @ 85-264 VAC
- h. Power dissipation, max: 3.4W
- g. Thermal dissipation, max: 11.6 BTU/hr
- h. Isolation Voltage: 250VAC (continuous)
- i. Indicators: 1 green/red module status indicator, 16 yellow/red I/O status indicators
- j. Input current per channel; (max): 15mA @264 VAC
- k. On-state voltage, min: 85 VAC min, 120VAC nominal
- l. On-state current per channel: 0.5A
- m. Output current per module, max: 4A
- n. Output delay time: ½ cycle time
- o. Environment: 5% relative humidity – 95% relative humidity non-condensing, -40°C (-40°F) to 60°C (140°F)

3. Digital Output Module shall be Allen-Bradley 5069-OA16

F. Analog Input Module

1. Where indicated on the Contract Drawings, the PLC system shall include an Analog Input Module. The Analog Input Module shall be capable of reading 8 4-20mA signals for the instruments indicated.
2. The Analog Input Module shall have the following ratings:
 - a. Inputs: 8 differential
 - b. Input range, voltage: +/- 10V, 0-10V
 - c. Input range, current: 0-20mA, 4-20mA
 - d. Mod Power: 75mA @18-32 VDC
 - e. Sensor/Actuator Power: 100mA @ 18-32 VDC
 - f. Sensor/Actuator Power (passthrough): 9.95A @ 18-32 VDC
 - g. Power dissipation, max: 2.4W
 - h. Thermal dissipation, max: 8.2 BTU/hr
 - i. Isolation Voltage: 250VAC (continuous)
 - j. Indicators: 1 green/red module status indicator, 4 yellow/red I/O status indicators
 - k. Normal mode noise rejection ratio: 65dB @50/60Hz, notch filter dependent
 - l. Input impedance: voltage mode > 1 MEG-ohm, current mode 250 ohm typical
 - m. Accuracy: 0.05% full scale
 - n. Scan time at 10kHz notch: 2msec / channel, 2 msec / group
 - o. Environment: 5% relative humidity – 95% relative humidity non-condensing, -40°C (-40°F) to 60°C (140°F)

3. Analog Input Module shall be Allen-Bradley 5069-IF8

G. Analog Output Module

1. Where indicated on the Contract Drawings, the PLC system shall include an Analog Output Module. The Analog Output Module shall be capable of generating 8 4-20mA signals for the where indicated.

2. The Analog Output Module shall have the following ratings:
 - a. Outputs Signal ranges: 8 voltage or current
 - b. Output range, voltage: +/- 10V, 0-10V
 - d. Output range, current: 0-20mA, 4-20mA
 - e. Mod Power: 75mA @18-32 VDC
 - f. Sensor/Actuator Power: 250mA @ 18-32 VDC
 - g. Sensor/Actuator Power (passthrough): 9.95A @ 18-32 VDC
 - h. Power dissipation, max: 5.3W
 - g. Thermal dissipation, max: 18.1 BTU/hr
 - h. Isolation Voltage: 250VAC (continuous)
 - i. Environment: 5% relative humidity – 95% relative humidity non-condensing, -40°C (-40°F) to 60°C (140°F)
3. Analog Output Module shall be Allen-Bradley 5069-OF8

H. Operator Interface

1. Contractor shall provide an Operator Interface Terminal (OIT) to display status and fault messages, and receive inputs from the operator.
2. The OIT display shall be a touch screen interface for programmable controllers to display pictorial information, data, and messages that are preloaded into it. The touch screen area shall be programmed to perform various functions to receive inputs from the operator and to provide animated graphic and text displays to provide operators a view into the operating state of a machine or process. The OIT display shall receive data and messages from the PLC processor via an Ethernet communications link. The Ethernet communications shall support Device Level Ring (DLR), linear, or star network topologies.
3. The display shall have a display viewing area of 261mm(W) by 163mm(H) (10.3in x 6.4in) 12.1" display.
4. The Operator Interface display shall have the following ratings:

Operating temperature	32°F to 131°F (0°C to 55°C)
Storage temperature	-13°F to 158°F (-25°C to 70°C)
Altitude	6562 ft (2000 m)
Relative Humidity	5 to 95% relative humidity, non-condensing
Power Consumption	50 watts max
CE (EMC)	Complies with EN61000-6-2, 61000-6-4,
CE (LVD)	Complies with EN 601010-2-201
Vibration endurance	0.012 pk-pk, 10-57 Hz
Shock	15g at 11 msec
Enclosure Rating	NEMA 4X / IP66 front panel
TFT Display	12.1" 1280 x 800 WXGA, 18-bit color
Aspect Ration	16:10
Brightness	~~400~~ 300 cd/m ²
5. Operator Interface shall be Allen-Bradley PanelView Plus 7.

I. Ethernet Switch

1. There shall be a five port Industrial Ethernet Switch to provide communications and Ethernet Connectivity between the various devices.
 2. The Industrial Ethernet Switch shall have the following characteristics and ratings:
 - a. Degree of protection: IP20
 - b. Ambient Temperature: 32°F to 140°F (0°C to 60°C)
 - c. Humidity: 5% to 95% (non-condensing)
 - d. Interface: Ethernet (RJ45)
 - e. Number of ports: 5 (RJ45 ports)
 - f. Note on the connection method: Auto negotiation and autocrossing
 - g. Transmission physics: Ethernet in RJ45 twisted pair
 - h. Transmission speed: 10/100 Mbps
 - i. Basic functions: Unmanaged switch / auto negotiation, complies with IEEE 802.3, store and forward switching mode.
 - j. Cascading Depth: Network, linear, and star structure
 - k. Maximum conductor length (twisted pair): 100m
 - l. Supply voltage: 24VDC
 - m. MTTF: 192 years
 - n. Conforms to EMC Directive 2004/108/EC
 3. Industrial Ethernet Switch shall be Phoenix Contact FL SWITCH SFN 5TX 2891152 or equal.
- J. The Contractor shall provide all discrete input modules, discrete output modules, analog input modules, and analog output modules required for interfacing to the instruments located at each pumping station.
- K. The Contractor shall provide any modem, communications module, antenna, telephone interface, cables, or other equipment to establish communications with a programmable controller and central computer located at the Ocean Pines Wastewater Treatment Plant. The programmable controller shall be programmed to accept commands from the central computer and transmit the status of any device or the measured value of any instrument in the pumping station.
- L. The programmable controller shall be programmed to provide a seamless and coordinated operation of all devices in the Pumping Station.

2.4 POWER SUPPLIES

- A. DC power supplies shall be of sufficient size to power all connected equipment with an additional 20% reserve.
- B. Performance Requirements
1. Enclosure degree of protection: IP20
 2. Humidity: <95% (at 25°C non-condensing)
 3. Nominal Input Voltage: 100-240VAC (wide range input)
 4. Input Voltage Range: 85-264 VAC
 5. Frequency range: 50 – 60 Hz+/- 10%
 6. Power consumption: 163 VA
 7. Inrush current limiting: < 20A
 8. Input fuse: 6.3 A

9. Power Factor: 0.82
10. Nominal Output Voltage: 24VDC +/- 1%
11. Nominal Output Current: 5A
12. Output Power: 120W
13. Output Voltage Range Setting: 24 - 29.5 VDC
14. Derating: > 60°C (140°F), 2.5% per Kelvin
15. Connection in parallel to increase redundancy and power

C. General Requirements

1. Isolation Voltage (input/output): 4kV/2kV
2. Enclosure Package Degree of Protection: IP 20
3. MTBF: greater than 1,532,000 hours (25°C), > 930,000 hours (40°C), >431,000 hours (60°C)
4. Ambient Temperature (Operation): -25°C to +70°C (-13°F to +158°F)
5. Storage Temperature: -40°C to +85°C (-40°F to +185°F)
6. Humidity: up to 95% at 25°C (77°F), no condensation
7. Conformance to EMC Directive 2014/30/EU
8. Conformance to Low Voltage Directive 2014/35/EC
9. Conformance to the EMC requirements for conducted noise emission EN 55016, and EN 61000-6-3 (Class B)
10. Conformance to the EMC requirements for noise emission EN 55016, and EN 61000-6-3 (Class B)
11. U/C-UL listed UL 508

- D. DC Power Supplies shall be one of the following: Phoenix Contact QUINT4-PS/1AC/24DC/5 2904600, or equal

2.5 POWER SUPPLIES

- A. DC power supplies shall be of sufficient size to power all connected equipment with an additional 20% reserve.

B. Performance Requirements

1. Enclosure degree of protection: IP20
2. Humidity: <95% (at 25°C non-condensing)
3. Nominal Input Voltage: 100-240VAC (wide range input)
4. Input Voltage Range: 85-264 VAC
5. Frequency range: 50 – 60 Hz +/- 10%
6. Power consumption: 72 VA
7. Inrush current limiting: < 20A
8. Input fuse: 2A
9. Power Factor: 0.47
10. Nominal Output Voltage: 24VDC +/- 1%
11. Nominal Output Current: 1.5A
12. Output Power: 30W
13. Switch-on time: < 1 sec
14. Output Voltage Range Setting: 22.5-28.5 VDC
15. Derating: from 55°C (131°F), 2.5% per Kelvin
16. Connection in parallel to increase redundancy and power

C. General Requirements

1. Isolation Voltage (input/output): 4kV/3kV

2. Enclosure Package Degree of Protection: IP 20
 3. MTBF: greater than 1,000,000 hours
 4. Ambient Temperature (Operation): -25°C to +70°C (-13°F to +158°F)
 5. Storage Temperature: -40°C to +85°C (-40°F to +185°F)
 6. Humidity: up to 95% at 25°C (77°F), no condensation
 7. Conformance to the EMC requirements for noise immunity EN 61000-6-1, and EN 61000-6-2
 8. Conformance to the EMC requirements for noise emission EN 61000-6-3, and EN 61000-6-4
 9. Conformance to EN 61558-2-16 for safety of transformers
 10. Conformance to IEC 60950-1/VDE 0805 (SELV) for electrical safety
 11. U/C-UL listed UL 508
- D. DC Power Supplies shall be one of the following: Phoenix Contact UNO-PS/1AC/24DC/30W 2902991, or equal

2.6 ELECTRIC HEATERS

- A. Provide electric heaters for outdoor control panels. Electric heaters shall be sized to protect sensitive mechanical, electrical, and electronic equipment from the harmful effects of condensation, corrosion, and low temperatures.
- B. Electric heaters shall be thermostatically controlled, fan driven units that can maintain a stable temperature within the control panel. Thermostat shall be adjustable from 0°F to 100°F (-18°C to 38°C).
- C. Electric heaters shall be Hoffman model DAH or equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Enclosures shall be provided with wiring, schematic, layout, connection, and control diagrams.

1.2 INSTALLATION

- A. Enclosure wiring shall be installed by the manufacturer and shall be brought out to identified terminal blocks. Interwiring between sections shall be from terminal blocks to terminal blocks. Terminal blocks for wiring shall be correlated with those for the electrical equipment by the enclosure manufacturer. Each terminal block shall contain no more than two wires on each side. Additional terminal blocks shall be provided when connection of more than two wires are required.
- B. Wiring for panel enclosures shall be neatly arranged in bunches taped or tied together at six inch intervals and shall be securely attached to the interior of the panel unless continued within plastic wireways. Identification of panel component and wiring shall be as shown on the submittals. Wiring to door mounted components shall be bundled and enclosed in flexible spiral wrap to provide protection to the wiring.
- C. Panels shall be grounded, and equipment and circuits included in the panels, as shown or required to be grounded, shall be connected to the grounding conductors.

- D. Equipment shown or specified to be furnished with the panels shall be mounted by the panel manufacturer. Panel mounted controls and components shall be mounted a minimum of 30" above finished floor and a maximum of 72" above finished floor. The panels shall be furnished as completely assembled units, requiring only field connections of power and control wiring.
- E. Pole or wall mounted panels shall be provided with brackets designed for pole or wall mounting.
- F. Where multiple power sources enter a single enclosure, a nameplate shall be provided indicating: "CAUTION: MULTIPLE POWER SOURCES" or similar warning.
- G. Not less than eight inches of clearance shall be provided between the terminal strips and the base of vertical panels for conduit and wiring space.
- H. AC and DC wiring shall be run in separate plastic wireways.
- I. Where different voltages are present within the enclosure, provide nameplates indicating the voltage levels applicable to terminals. Terminals for 480 VAC and 120 VAC shall be separated a minimum of six inches. If the enclosure contains low voltage instrumentation wiring and terminals, the wiring and terminal blocks shall be separated from the 120 VAC and 480 VAC wiring by a minimum of six inches. The terminal blocks for low voltage instrumentation wiring shall be enclosed in a separate steel enclosure inside the terminal cabinet for shielding.
- J. Power terminal blocks shall be provided with clear Lexan shields removable without removing the power terminal blocks.

1.3 FIELD TESTS

- A. The panel shall be checked and necessary adjustments shall be made in the field after installation, by representatives of the manufacturers of the equipment included in the panel.
- B. The panel shall be functionally tested by simulating the inputs. Tests shall be in the presence of the Engineer.

** End of Section **

SECTION 26 09 16
MISCELLANEOUS ELECTRICAL CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

This Section includes miscellaneous controls, electric indicating instruments, instrument transformers, elapsed time meters, pressure and limit switches, control stations, pushbuttons, selector switches, and indicators and all appurtenances necessary for a complete installation.

1.2 SUBMITTALS

- A. Submittals shall conform to the requirements given in Section 26 00 00 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference.
- B. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications, associated standards and test requirements.
- C. Prior to obtaining any material in connection with this section, catalog data and detailed wiring connection diagrams shall be submitted. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings, circuit diagrams, and dimensional data, as a minimum. Drawings shall include elementary and interconnection diagrams showing connections to internal components, and indicate field termination points for power and control interface. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted.
- D. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly and section views, and all necessary details pertaining to coordinating the work of the Contract, lists of materials and finishes, parts list and the descriptions thereof, lists of spare parts and tools where such parts or tools are required, and any other information that is required to demonstrate compliance with the Contract Documents. Drawings for electrical equipment shall include elementary and interconnection diagrams showing connections to internal components, and indicating field termination points for power and control interface.
- E. Submittal shall contain manufacturer's descriptive data including ratings, circuit diagrams, and dimensional data.
- F. Samples of any material shall be submitted upon Engineer's request.

1.3 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. National Electric Code (NEC)
 2. National Electrical Manufacturers Association (NEMA)
 3. Underwriters Laboratories, Inc. (UL)
 4. International Electrotechnical Commission (IEC)
- B. Uniformity: Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.

PART 2 PRODUCT

2.1 CONTROL RELAYS AND CONTACTORS

A. Plug-In Control Relays (Control Panel Applications)

1. General purpose control relays shall be provided where control functions require remote indicating functions, use of interposing relays, or for other control functions where installed in control panels, annunciator panels, and display panel applications.
2. Control panel relays shall be plug-in type. Provide 120 VAC coil relays with pin-type construction for AC control wiring and 24 VDC coil relays for DC control wiring. AC coil relays shall be pin type construction and DC coil relays shall be blade-type construction. Provide 8 or 11 pin-type or blade-type sockets as required for mounting relays.
3. Control panel relays shall be provided with a pushbutton for testing the operation of the relay and other control functions.
4. Control relays shall be provided with an integral indicating light to show the state of the relay coil (energized or de-energized) and contacts.
5. Contacts for use with analog circuits shall be Silver Cadmium Oxide type rated for 10 amperes at 240 VAC. Solid State Timing Relays (TR) shall have adjustable time settings within adjustable time
6. Control relays shall be as manufactured by:
 - a. Square D – Class 8501 type K
 - b. Idec – RR Series
 - c. Allen-Bradley 700
 - d. Automation Direct 728
 - e. Potter & Brumfield
 - f. equal

B. Solid State Timing Relays

1. Solid state timing relays shall have adjustable time settings within adjustable time ranges.
2. Timing ranges shall be adjustable from 0.5 seconds to 24 hours, unless noted otherwise.
3. Timing relays shall have four selectable modes: on-delay, off-delay, one-shot, and repeat

cycle.

4. Solid state timing relays shall be as manufactured by Square D Class 9050 type JCK, or equal.

C. Solid State AC Current Relays

1. Solid state AC current relays shall be designed to sense AC overcurrent conditions. The relays shall be used as a means to monitor motor torque for the Sludge Holding Tank Mixers.
2. Relays shall have the following delay modes: Start Delay, Trip Delay, and Inhibit Delay
3. Relays shall operate on 120 VAC power supply and shall be wired as shown on the Contract Drawings.
4. Relays shall be Type 809S as manufactured by Allen Bradley or equal.

D. Pump Alternation Relays

1. Alternation relays shall change the sequence of the pumps after every cycle of operation.
2. The alternation relay shall plug into a standard octal pin relay socket and include position indicating lights.

E. Heavy Duty Machine Tool Relays

1. Heavy duty control relays shall be provided for operation where installed in motor control centers or individually enclosed motor starters.
2. Control relays shall be of the heavy duty, 600 VAC machine tool type, designed for rapid cycling duty or continuous operation.
3. Relays shall be of modular construction capable of mounting adder decks to increase the number of output contacts. Contacts shall be convertible in the field from normally open to normally closed and vice-versa, without additional parts. Relay armatures shall be operable manually, without power, for testing purposes.
4. Timing relays provided for use with reduced voltage motor starter applications shall be the standard product of the motor starter manufacturer.
5. Heavy duty machine tool relays shall be as manufactured by:
 - a. Square D – Class 8501 Type C
 - b. General Electric – Type CR120B
 - c. equal

F. Lighting Contactors

1. Lighting contactors shall be designed for ballast lighting rated at 30 amperes. The contactors shall have two poles minimum and be used as a means to control the lighting in the lighting control panels.

2. The contactors shall have the following features:
 - a. Electrically and mechanically held
 - b. Field convertible with N.O. and N.C. indicators, 8 N.C. contacts maximum.
 - c. Silver-Cadmium-Oxide double break contacts
3. The contactors shall be UL listed and labeled.
4. Contactors shall be as manufactured by Square D Class 8903, or equal.

G. Intrinsically Safe Relay (Barrier Relays)

1. Intrinsically safe relays shall be provided with an energy barrier limiting the available voltage and current in the Hazardous Location. The relays shall interface with non-explosion proof field devices which are mounted in the Hazardous Locations. The circuits shall be suitable for installation in Class I, Group D, Division 1 Hazardous Locations.
2. The relay shall be constructed of plastic or glass reinforced nylon suitable for back plate mounting or din rail mounting. Terminals shall have captive screws with self-lifting clamps.
3. Intrinsically safe relays shall be single channel relay, accepting a dry contact input. The relay shall operate on 120 VAC, 1 phase power supply and shall be provided with two SPDT output relays to obtain 2 NO and 2 NC contacts. Contacts shall be rated 5 amperes minimum.
4. The relays shall be as manufactured by Square D Company - Model NY2 A1, or equal

H. Intrinsically Safe Relay (Barrier Relays)

1. Intrinsically safe relays shall be provided with an energy barrier limiting the available voltage and current in the Hazardous Location. The relays shall interface with non-explosion proof field devices which are mounted in the Hazardous Locations. The circuits shall be suitable for installation in Class I, Group D, Division 1 Hazardous Locations.
2. The relay shall be constructed of plastic or glass reinforced nylon suitable for back plate mounting or din rail mounting. Terminals shall have captive screws with self-lifting clamps.
3. Intrinsically safe relays shall be six channel relay, accepting a dry contact input. The relay shall operate on 120 VAC, 1 phase power supply and shall be provided with two SPDT output relays to obtain NO and NC contacts.
4. The relays shall be as manufactured by Idec – Model EB3C.

I. Galvanic Barrier, Loop Powered, Intrinsically Safe Signal Barrier

1. Galvanic signal barrier shall be provided to limit the energy from sensors or analog devices in the Hazardous Location. The signal barrier shall interface with non-explosion proof field devices which are mounted in the Hazardous Locations. The circuits shall be suitable for installation in Class I, Group D, Division 1 Hazardous Locations.
2. Specifications
 - a. Signal Range: 4 to 20 mA; available transmitter voltage >16V for supply voltage >21V.
 - b. Safe Area Output: 4 to 20 mA; transmitter voltage < 30 VDC.

- c. response time < 20 usec at 0, and <600 usec 800 load
- d. maximum power dissipation: 150 mW @ 20 mA and V < 24V
- e. Temperature Limits: -4° to 140°F (-20° to 60°C)
- f. Agency Approvals: CE, FM.

- 3. The intrinsically safe signal barrier shall be Dwyer Instruments KFD0-SCS-EX1.55 or equal.

J. Three Phase Power Monitor Relays

- 1. Three phase power monitor relays shall detect phase loss, voltage and phase reversal, and low voltage line conditions. The relay shall continuously monitor the three phase power lines for abnormal conditions. The monitor shall consist of a solid state voltage and phase angle sensing circuit coupled to a electromechanical relay.
- 2. The three phase power monitor shall be suitable for monitoring 480 VAC, 3 phase, 60 Hz. power systems. The output relay shall be provided with a field adjustable trip delay feature and provided with a single pole double throw form contacts rated at 5 amperes minimum.
- 3. The relay shall be provided with a red LED type failure indicator.
- 4. The relays shall be as manufactured by:
 - a. SSAC Inc.- RLM Series
 - b. Time Mark Corporation - Model 252
 - c. equal

H. Three Phase Power Monitor Relays

- 1. Three phase power monitor relays shall detect phase loss, voltage and phase reversal, and low voltage line conditions. The relay shall continuously monitor the three phase power lines for abnormal conditions. The monitor shall consist of a solid state voltage and phase angle sensing circuit coupled to a electromechanical relay.
- 2. The three phase power monitor shall be suitable for monitoring 480 VAC, 3 phase, 60 Hz. power systems, 240 VAC, 3 phase, 60 Hz power systems, or 208 VAC, 3 phase, 60 Hz systems. The output relay shall be provided with a field adjustable trip delay feature and provided with a single pole double throw form contacts rated at 5 amperes minimum.
- 3. The relay shall be provided with an LED type status indicator.
- 4. The protection relay shall meet the following requirements:
 - a. Frequency 50/60 Hz
 - b. Low voltage trip 90%, +/- 1%
Low voltage reset 93% +/- 1%
 - c. Voltage Unbalance (NEMA) trip 6%
reset 4.5%
 - d. High voltage trip 110% +/- 1%
High voltage reset 107% +/- 1%
 - e. Trip delay time High/low voltage fault 4 seconds
unbalance and phasing faults 2 seconds
 - f. Restart time 2 seconds

- g. Output contact ratings (SPDT) 10A at 240VAC
 - h. Temperature -20° C to 70° C (-4° F to 158° F)
 - i. Relative Humidity 10-95% non-condensing per IEC 68-2-3
 - j. Trip and reset accuracy +/- 1%
 - k. Maximum input power 5W
5. The relays shall be as manufactured by:
- a. Littlefuse – 201A series
 - b. equal

2.2 PUSHBUTTONS, SELECTOR SWITCHES, INDICATOR LIGHTS

- A. All field mounted devices shall be heavy duty, oiltight, with die cast operator bodies, and molded modular type contact blocks.
- B. Unless noted otherwise, pushbuttons, selector switches, and indicator lights mounted on the front of control panels shall be the 30mm, heavy duty, industrial style.
- C. Pushbuttons, selector switches, and indicating lights shall be configured as shown on the Contract Drawings, specified, or detailed. (e.g. momentary contacts, maintained contacts, 2-position, lockout type, spring return to center, or other control functions).
- D. Pushbuttons
 - 1. Pushbuttons shall have color button operator with guards, engraved legend plates, and contact blocks as required.
 - 2. Stop pushbuttons shall be of the mushroom head type.
 - 3. Emergency stop pushbuttons shall be of the maintained contact type, push to stop, pull to release, with the extra large mushroom style knob, legend plate, and color appropriate for an emergency stop function.
 - 4. Lockout stop pushbuttons shall be designed to accommodate a padlock in the stop position
- E. Selector Switches
 - 1. Selector switches shall have glove hand type operators, engraved legend plates, and contact blocks as required.
 - 2. Selector switches for use with analog circuits shall be provided with gold plated contacts
- F. Indicating Lights
 - 1. Indicating lights shall be wired for "push-to-test" operation when specified, shown, or required.
 - 2. Indicating lights shall be 120 volt transformer type unless otherwise noted.

3. Indicating lights shall be provided with interchangeable color caps.
4. Indicating lights shall be provided with engraved legend plates stating the intended control function and purpose.

G. Pushbutton and Indicator Light Colors

1. Unless otherwise noted, pilot light and pushbutton colors shall be in accordance with NFPA-79 Industrial Machinery, modified below to provide additional definition.
2. Indicator Lights Colors
 - a. Red – On/Open/Danger/Alarm
 - b. Green – Off/Closed/Ready
 - c. Yellow or Amber – Caution/Attention
 - d. White – Power On/Energized
 - e. Blue – Miscellaneous
3. Pushbutton Colors
 - a. Red – Stop/Off/Emergency Stop
 - b. Green – Start/On
 - c. Yellow or Amber – Intervention/Return
 - d. Black – No specific function

H. Manufacturers

1. Square D Class 9001 Type K
2. Allen-Bradley Bulletin 800T
3. General Electric CR2940
4. equal

2.3 CONTROL STATIONS

- A. Control stations of less than sixteen units, located in non-hazardous areas and in Dry Locations shall be rated NEMA 13, oiltight, die cast, with synthetic rubber gaskets, threaded conduit openings, pre-punched gasketed pushbutton openings, and concealed hinge covers.
- B. Control stations of more than sixteen units, located in non-hazardous areas and in Dry Locations shall be rated NEMA 12, with hinged and gasketed covers, and punched pushbutton openings.
- C. Control stations located in Hazardous Areas shall be approved for Class I, Division 1, Group D atmospheres. Control stations shall be rated NEMA 7 with approved pushbutton assemblies.
- D. Control stations located in Wet Locations or Corrosive Areas shall be NEMA 4X, fiberglass reinforced thermoplastic enclosures with gasketed covers and conduit holes. Grounding bushings shall be provided on all metallic conduits entering the control stations and metallic pushbuttons.
- E. Control station manufacturers:
 1. Non-hazardous control stations (less than sixteen units)
 - a. Allen-Bradley Bulletin 800T Series TZ
 - b. General Electric CR2940 Series BC
 - c. Square D Class 9001 Type KYK

- d. equal
- 2. Non-hazardous control stations (greater than sixteen units)
 - a. Hoffman NEMA 12 or NEMA 4X enclosures
 - b. equal
- 3. Hazardous location control stations
 - a. Crouse-Hinds NEMA 7 control station
 - b. equal
- 4. Corrosive Area and Wet location control stations
 - a. Square D Class 9001 Type SK
 - b. Hoffman Series PBRFG
 - c. Equal

2.4 MISCELLANEOUS CONTROLS FUNCTIONS

A. Elapsed Time Meters

Elapsed time meters shall be provided where shown on the Contract Drawings. The time meters shall have synchronous clock motor movements for service at 115 VAC, single phase at 60 Hertz, and 3 inch dials with 6 digits, calibrated in hours and tenths of an hour. The elapsed time meters shall be Westinghouse Type BH-351, General Electric Type 240 or equal.

B. Alarm Horns

- 1. Alarm horns shall be provided with die cast aluminum wiring box and a black molded polycarbonate grille. Alarm horns shall be suitable for control panel or stand-alone wall mounting as shown on the Contract Drawings. Alarm horn output levels shall be field adjustable with factory setting of 88 dB at ten feet. Alarm horns shall be rated for continuous duty with an operating temperature range 0-95 degrees Fahrenheit. Alarm horns shall operate on 120 VAC, single phase power supply.
- 2. Alarm horns shall be weatherproof, rated NEMA 4X. The Alarm horn shall be Tork Model TA876-N5, or equal.

C. Power Conditioner

- 1. Power conditioners shall be furnished to provide power protection against sags, surges, swells, spikes, and electrical noise. The power protection unit shall provide noise suppression and fast microcomputer-controlled voltage regulation.
- 2. Power conditioners shall be rated for 10 kVA with a 208 VAC, 3 phase input power rating and a 208/120 VAC, 3 phase power output rating. Unit shall be hardwired to a 208/120 VAC, 3 phase lighting panelboard.
- 3. Power conditioners shall be Model 62610-Line 2 as manufactured by Square D Company, or equal.

D. Photocells

1. Photocells shall be provided to control automatic operation of the site and area lighting fixtures. The Photo-controller shall be mounted inside the Lighting Control Panel and the sensor mounted outside the building against the wall in an area where it is less likely to be illuminated by car lights.
2. Photocells shall be suitable for operation on a 120VAC, single phase power and UL listed.
3. Photocell shall include a built-in time delay to prevent false triggering and shall be able to control up to 64 circuits of lighting.
4. Photocells shall be provided where shown on the Contract Drawings. Provide two (2) spare photocell units.
5. Photocells shall be Lithonia, model Panelmax/LPC with the features specified above or equal.

E. Limit Switches

1. Mechanical limit switches shall have a heavy duty, snap action mechanism that prevents false contact opening. Limit switches shall be the lever arm with hardened roller configuration.
2. Limit switch enclosure shall be metal and rated NEMA 4. Limited switch shall use a booted shaft design to prevent penetration of foreign materials.
3. Provide 1 N.O. and 1 N.C. set of contacts, rated for 20 amperes. Wire insulation shall be rated for 600VAC and DC.
4. Limit switch shall meet the following requirements:
 - a. Temperature range: 0°F to 200°F (-17°C to 93°C)
 - b. Vibration resistance: 30G max (10-55 hz)
 - c. Repeatability: 0.03°.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. All controls unless shown otherwise shall operate at 120 VAC.
2. All electrical control components shall be installed as shown and specified in the Contract Documents, as directed by the County and as recommended by the manufacturers.
3. The enclosures containing electrical components shall be solidly grounded with a ground conductor as specified in Section 16450.
4. Where existing controls are shown to be utilized for new functions, a new, permanent tag shall be provided to identify the new control function.

B. Field Tests

1. After installation, all controls shall be checked and the required adjustments shall be made.
2. Each control function on each piece of equipment shall be field tested and certified to be functioning by the Contractor. Contractor shall notify Engineer three days in advance of this test and allow the Engineer to be present during testing. Equipment shall be field tested in the presence of the Engineer and shall be demonstrated to operate satisfactorily.
3. In the event of failure of the field test, the Contractor shall retest the equipment, at his own cost and expense, as directed by the Engineer.

****End of Section****

SECTION 26 24 19
MOTOR CONTROL CENTER

PART 1 GENERAL

1.1 DESCRIPTION

This section includes requirements for a standard pre-fabricated motor control and all required control devices and distribution assemblies as shown on the Contract Documents. The power system feeding the MCC shall be 480 VAC, 3-phase, 4-wire, 60Hz, unless otherwise indicated.

1.2 QUALITY ASSURANCE

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. National Electrical Manufacturer's Association (NEMA)
 - 3. Underwriters Laboratories, Inc. (UL) 845
- B. Manufacturer's Qualifications. Provide materials and equipment that are the products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products shall have been in satisfactory commercial or industrial use for five (5) years prior to bid opening. The 5-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 5-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.
- C. Uniformity: Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.
- D. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with NEMA, IEEE, or other applicable technical standards and shall have a neat and finished appearance.
- E. Installation: Erect equipment in a neat and workmanlike manner; align, level, and adjust for satisfactory operation. Install equipment so that parts are easily accessible for inspection, operation, maintenance, and repair. Minor deviations from the indicated arrangements may be made, but only after obtaining approval from the Engineer.

1.3 SUBMITTALS

- A. Submittals shall conform to the requirements given in Section 26 00 0 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model or number, complete part number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference.

- B. Drawings for electrical equipment shall include:
1. Assembly outline drawings
 2. Front view elevation
 3. Floor plan and top view plan, detailing conduit entry locations
 4. Unit wiring diagrams
 5. Elementary control diagrams
 6. Nameplate schedule
 7. Starter and component schedule
 8. Interrupting ratings
 9. Time-current characteristic curves for all circuit protective devices
 10. Bill of materials for all components in the MCC
 11. Catalog data sheets for all components
 12. Elevation view or layout of all MCC cubicle sub-panels
 13. Installation and support details
 14. Cable terminal sizes
- C. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications and associated standards. This list shall include full information, including manufacturer's complete part numbers regarding all components of the equipment.
- D. Shop drawings shall include manufacturer's catalog data. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings, circuit diagrams, and dimensional data as a minimum.
- E. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly and section views, and all necessary details pertaining to coordinating the work of the Contract, lists of materials and finishes, parts list and the descriptions thereof, lists of spare parts and tools where such parts or tools are required, and any other information that is required to demonstrate compliance with the Contract Documents.
- F. Detailed descriptive material shall be provided to demonstrate compliance with the Contract Documents. Shop drawings shall include:
1. Summary sheets
 2. Sequence key interlocks
 3. Transient voltage surge suppression information
- G. For NEMA Class II Motor Control Centers, additional shop drawings shall be submitted including interwiring diagrams and field connection diagrams.
- H. Where Motor Control Center is shipped in more than one sections, shop drawings shall clearly show all field interwiring required to maintain circuit continuity upon reassembly.
- I. Manufacturer's Certificate of Installation
- J. Operations and maintenance Manual
- K. Samples of any material requested by the Engineer

1.4 CLOSEOUT SUBMITTALS

Provide project record documents which record actual equipment configuration and locations of components and circuits.

PART 2 PRODUCTS

2.1 MOTOR CONTROL CENTER

A. General

Motor control centers shall be in accordance with the applicable Sections of the NEMA Publication "Industrial Controls and Systems" ICS-1977 except as modified below.

B. Mechanical Construction

1. Structural and Dimensions

- a. Structures shall be totally enclosed, dead-front, free-standing assemblies.
- b. Control centers shall consist of the required number of standard vertical sections each 90 inches high and 20 or 21 inches deep unless otherwise indicated.
- c. Each control center vertical section shall be constructed of a rigid steel enclosure, fabricated from formed sheet steel of not less than 14 gauge thickness adequately reinforced with steel frame of not less than 12 gauge.
- d. All sections shall have the same structural design with provisions for adding similar sections at either end. Units of similar size shall be interchangeable. Unless otherwise specified, motor control center shall be NEMA 12 enclosure.
- e. Control centers shall be furnished by the manufacturer as completely assembled units where transportation and installation requirements permit. Each assembly shipped as a unit shall be joined together with a pair of mounting channels at the bottom and with a lifting angle at the top. Each installed assembly shall be joined together to form a rigid freestanding structure. Where length of each submitted assembly exceeds the dimensions shown on the Contract Drawings additional work required to the furnishing contract or other contracts shall be at the cost of the furnishing contract. Shipping units shall be as large as practicable with respect to transportation and installation restrictions.
- f. All components of motor control centers shall be completely front accessible.
- g. Motor Control Center shall include top and bottom horizontal wireways.

2. Vertical Sections. Each vertical section shall be provided with horizontal bus and wire spaces separate from each other. Bus and wire spaces shall line up with the similar spaces in adjacent sections. A separate vertical wire space compartment with separate door and suitable wiring clamps shall extend the full height of each section and shall connect with the horizontal wire spaces. The vertical compartment shall be isolated from unit compartment except for required openings for conductors.

3. Pull Box Compartments. Pull box compartments for horizontal wiring shall be provided at the top or bottom of the motor control center.

4. Incoming Line Compartment. Incoming line compartment shall be front accessible but isolated from main bus and other compartments.

5. Unit Compartment. Each unit compartment shall be provided with an individual front door. An operating mechanism shall be mounted on the primary disconnect of each starter or feeder unit. Starters and feeder unit doors shall be interlocked mechanically with the unit disconnect device to prevent unintentional opening of the door while energized and unintentional application of power while door is open. Means shall be provided for releasing the interlock for intentional access to the interior at any time and intentional application of power, if desired, while door is open. Padlocking arrangements shall permit locking the disconnect device OFF with at least three padlocks with door closed or open.
6. Bus Compartments. The horizontal power bus shall be isolated from all wiring troughs and other working areas. Vertical bus extensions shall be isolated in such a manner as to be a separate self-supported assembly. No extra safety jacks or similar devices shall be required to obtain an essentially dead-front condition. Access shall be provided for inspection and maintenance from the front.
7. Draw-out Connections. Stab-in units up to 48 inches high shall be full drawout and shall not be able to be inserted or withdrawn unless the unit disconnect is OPEN. Units can be withdrawn without disconnecting any wiring. Units over three space units high may be bolt-in type. A positive guidance system shall be provided to assure proper alignment of wedge-shaped power stabs in dead-front openings in vertical power bus. The screw racking mechanism shall serve as a mechanical advantage to the operator during unit insertion or removal. Stab-in power terminals shall be of a type that will increase contact pressure on short circuits. Bolt-in starter units, sizes 5, 6 and 7 shall be of closed-door construction such that the unit cannot be opened until power is disconnected from the vertical bus to the line side of the unit.

C. Electrical Construction

1. General
 - a. All buses shall be of the tinned copper construction type.
 - b. The service entrance compartment shall have the required number and size of lugs required to accommodate the entrance conductors as shown on the Contract Drawings.
 - c. Motor control centers shall be NEMA Class II, Type B construction unless otherwise shown.
2. Short Circuit Ratings
 - a. The complete Motor Control Center shall be "Integrally Equipment Rated" in accordance with UL requirements and shall be suitable for connection to an available fault of 65,000 RMS symmetrical amperes minimum or as shown on the Contract Documents.
 - b. All electrical components (fuses, breakers, motor starters, etc) shall be provided as a coordinated system designed and installed so the system can withstand and interrupt the short circuit current shown above or on the Contract Drawings as the Minimum Interrupting Capacity.
3. Busbars. Busbars shall be protected from physical damage and held firmly in place.
 - a. The main horizontal buses in the motor control center shall have the minimum capacity of 600 amperes/800 amperes/1200 amperes/1600 amperes/2000 amperes/2500 amperes/3200 amperes or as shown on the Contract Drawings. The buses shall be supported with insulating blocks to withstand mechanical stresses that can be set up by symmetrical short circuit currents previously noted.

- b. Vertical buses shall have a minimum capacity of 300 amperes/600 amperes/800 amperes/1200 amperes or as required for the load shown or as indicated on the Contract Drawings and shall extend the full height of each vertical section.
 - c. A ground bus shall be provided across the assembly and shall be a minimum of 1 inch by ½ inch.
 - d. A neutral buss shall be provided. It shall be a full capacity isolated neutral pad or neutral bus and shall be provided within the Disconnect or Incoming Service section.
4. All control wire shall be 16 gauge minimum.
5. Motor Control Center shall be service entrance rated.
- a. Where used as service equipment, each motor control center shall be provided with a single main disconnecting means to disconnect all ungrounded service conductors.
 - b. Barriers shall be placed in all service entrance motor control centers to isolate service busbars and terminals from the remainder of the motor control center.
 - c. Barriers shall be placed in all service-entrance motor control centers to isolate service busbars and terminals from the remainder of the motor control center.

D. Components

1. General
- a. Motor control centers shall provide equipment of the type capacity and trip ratings shown or otherwise specified. The arrangement of the equipment in the motor control center, shown on the Contract Drawings, is diagrammatic only, and is shown for the purpose of indicating the service requirements at the control center.
 - b. The manufacturer of this equipment will be permitted to arrange it to the best advantage and will not be required to furnish spare compartments except where necessary to complete a vertical section or except where specifically shown. Cover plates shall be provided for unused compartments.
 - c. Motor control center components shall meet the detail provisions of the applicable sections as listed elsewhere in these specifications. This shall include, but not be limited to Motor Controllers, Panelboards and Circuit Protective Devices, and Miscellaneous Electrical Controls.
 - d. Motor control center supplier shall coordinate the installation of the Pump Moisture Detector Control Relay and any other components required for the operation of the pump motor in the MCC cubicle.
2. Instrument Transformers
- a. Current transformers to be supplied with each motor control center shall be of the dry, wound type with fully coordinated insulation for 600 VAC insulation class. Transformer ratios shall be determined by the MCC manufacturer. Transformers shall be completely compatible with the digital metering units specified.
 - b. All potential transformers shall be rated 480 to 120 VAC.
 - c. Transformers shall be in an accuracy class to meet the requirements of ANSI Standards, and for secondary burdens connected to the transformers.

E. Identification of Components

1. The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed in a conspicuous location. Other markings shall indicate voltage, current, number of phases, and other relevant electrical ratings. The marking shall be of sufficient durability to withstand the environment.

2. Control centers shall be provided with engraved nameplates on the door of each compartment. Nameplates shall have white lettering on black background, with 1/4-inch high capital letters, unless otherwise shown or specified. Each compartment containing a motor controller, relay panel or similar equipment shall have an approved elementary diagram pasted inside the compartment door. Other compartments shall have approved unit wiring diagrams pasted inside the door. In addition, each compartment containing a motor controller shall have an overload heater selection table pasted inside the door.
3. All control components such as relays, timers, etc. shall be identified by means of durable tags or printed symbols which shall bear the same code letters or numbers which appear on the shop drawings as device identification code.
4. All terminal boards shall bear numbers which shall be the same as the wire numbers used on the shop drawings. All shop and field wires shall be tagged to show clearly the number designation at each end of each wire.
5. The Contractor shall compile a final wire list showing all circuit designations, originations, and terminations, and submit this list to the Engineer.

2.2 POWER METERING

- A. Provide power metering equipment as indicated on the Drawings. Power metering equipment shall measure three phase voltages and currents at the incoming electrical service and the three pump motors for each pumping station.
- B. Power metering equipment shall provide true rms metered values. Information provided shall include frequency, temperature, current, demand current, voltage, real power, reactive power, apparent power, demand power, power factor, accumulated energy, total harmonic distortion of each current and voltage, and K-factor of each current.
- C. Power metering equipment shall be rated for an operating temperature range of -25° C to 70° C and have an overcurrent withstand rating of 500 amperes for 1 second.
- D. All setup parameters shall be stored in nonvolatile memory.
- E. Power metering equipment shall accept metering inputs of up to 600 VAC direct connection and from industry standard instrument transformers (120 VAC secondary potential transformers and 5 ampere secondary current transformers). Connect to 480/277 VAC circuits shall be possible without the use of potential transformers.
- F. Power metering equipment shall communicate via RS-232, RS-485 simultaneously. Power metering equipment shall be capable of communicating to 3 additional Modbus devices using RS-485 daisy chains. Power metering equipment shall report the three line-line voltages and three line currents to the existing SCADA controller using the Modbus communications network.

PART 3 EXECUTION

3.1 PACKING AND SHIPPING

The Motor Control Center shall be separated into shipping blocks of no more than three vertical sections each. Shipping blocks shall be shipped on their sides to permit easier handling at the job site. Each shipping block shall include a removable lifting angle which will allow a convenient means of attaching an overhead crane or other suitable lifting equipment.

3.2 STORAGE

If the Motor Control Center must be placed into storage after its receipt, it shall be stored in a clean, dry, and ventilated building free from temperature extremes. Acceptable storage temperatures are from 0°C (³²°F) to 40°C (104°F).

3.3 SHOP PAINTING

- A. The manufacturer of the motor control center shall apply a rust-resisting treatment, primer coat of paint and a finish coat of enamel.
- B. Furnish at least one pint of touch-up enamel matching the finish coat of the motor control center with each assembly. Where the assembly exceeds four vertical sections, one quart of touch-up paint shall be furnished.

3.4 INSTALLATION

- A. Motor control centers shall be mounted on raised concrete equipment pads. After the motor control center has been erected and installed on the base, the Contractor shall inspect all internal components and he shall check and tighten all connections. Connections to external equipment and connections of the incoming services shall be as shown or as required by equipment manufacturer.
- B. Wires from each compartment shall be individually bounded and tagged. Other than for required interconnections and control wiring, only those conductors that are intended for termination in a vertical section shall be located in that section.
- C. No splicing of wires shall be allowed in control center wireways.
- D. All control center enclosures and ground buses shall be connected to the grounding grid in accordance with Section entitled, "Electrical Grounding".
- E. Foreign voltage connections to any compartment shall be provided with a warning label and the conductors shall be labeled to identify them as utilizing a foreign voltage.
- F. After installation, performance shall be checked and required adjustments shall be made by the manufacturer's representatives before placing control centers in service. The Contractor shall provide, at his own expense, the manufacturer's services for the purpose of checking and adjustments shall be part of the Contract.
- G. The Contractor shall coordinate all electrical work involving existing circuits and operations with the Owner for required shutdowns, conversions, and tie-ins.

3.5 FIELD QUALITY CONTROL

The services of a manufacturer's representative shall be provided to perform on-site inspection of the installation of the motor control centers and power wiring connections. The Contractor shall provide a manufacturer's Certificate of Installation to the Engineer indicating that the motor control centers have been installed in accordance with the manufacturer's installation instructions.

**** End of Section ****

SECTION 26 28 00
PANELBOARDS AND CIRCUIT PROTECTIVE DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

This section includes low voltage panelboards, circuit breakers, disconnect switches, fuses, and other circuit protective devices for service at 600 VAC or less.

1.2 QUALITY ASSURANCE

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Underwriters Laboratories, Inc. (UL) 1449
 - 4. American National Standards Institute (ANSI)
- B. Qualifications of manufacturer. Provide materials and equipment that are the products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.
- C. Uniformity. Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.

1.3 SUBMITTALS

- A. Submittals shall conform to the requirements of Section 01 33 00 Submittals, and to the requirements given in Section 26 00 00 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model, layout dimensions, project specification, and technical paragraph reference.
- B. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications, associated standards and test requirements.
- C. Prior to obtaining any material in connection with this section, detailed shop drawings on all material shall be submitted. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings, circuit diagrams, and dimensional data, as a minimum. Drawings shall include elementary and interconnection diagrams showing connections to internal components, and indicate field termination points for power and

control interface. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted.

- D. Submittals shall contain complete part numbers for all materials, including the panelboard enclosure, the neutral bar, the ground bar, the lugs, and the circuit breakers. And the submittal shall include an explanation of each part number, and the options and alternatives available
- E. Submittals shall also contain descriptive data and time-current characteristic trip curves for each type of circuit breaker or fuse. These curves shall be submitted on full size manufacturer's drawings.
- F. Samples of any material shall be submitted upon Engineer's request.

1.4 CLOSEOUT SUBMITTALS

Provide project record documents which record actual circuit directories, as well as actual locations of components and circuits.

PART 2 PRODUCT

2.1 PANELBOARDS

A. Panelboards

1. Panelboards shall meet Federal Specification W-P-115B, Type 1, Class 1, and shall conform to UL50 UL67, and NEMA PB-1.
2. Loadcenters (Federal Specification W-P115C Type 1 Class 2) shall not be substituted for panelboards unless specifically indicated.
3. Panelboards shall be circuit breaker type as shown on the drawings with neutral bar, ground bar, and main and branch circuit breakers as scheduled.
 - a. Unless otherwise shown, scheduled or specified, bus bars, ground bar, and neutral bar shall be copper or tin plated aluminum.
 - b. Panelboards shall be furnished and installed in accordance with the panelboard schedules as shown.
 - c. Subject to Engineer's review, such schedules may be revised to obtain more convenient grouping and better balance of the actual connected load.
4. Panelboards shall be provided with ample wiring gutters and shall have a single door with spring door hinges, lock, keys, and cardholder on the side of the door. Circuit identification cards shall be typewritten with circuits identified as actually installed.
5. Panelboards shall have single, double, or triple pole bolt-on branch circuit breakers as scheduled.
 - a. Branch circuit breakers shall be in accordance with subsection headed "Molded Case Circuit Breakers".
 - b. Unless otherwise shown, circuit breakers shall be rated at 20 amperes.
 - c. Circuit breakers shall be provided for all spares shown on the schedule.

6. Short circuit current requirements shall be obtained only from the schedules, specifications, or the Contract Drawings.
 - a. If this information is not shown, the Engineer shall be consulted.
 - b. Under no circumstances shall any short circuit requirements be assumed by the Contractor.
 - c. Integrally rated panelboards utilizing branch breakers with reduced short circuit ratings are acceptable.
7. Panelboards with main circuit breakers serving as building disconnecting means shall be service entrance rated, and shall be provided with a plaque designating the circuit breaker as a building disconnecting means.
8. Provide surge suppression for panelboards in accordance with Section 26 43 13 Transient Voltage Surge Suppression. Devices for surge suppression may be an integral part of the panelboard.
9. Panelboard enclosures shall be provided with key-locked doors. Provide a minimum of two keys for each lock.
10. Manufacturers
 - a. 120/208 VAC and 120/240 VAC, 3 Phase Panelboards. Unless otherwise indicated, four wire 120/208 VAC and 120/240 VAC panelboards shall be: bolt-on AQ Series manufactured by General Electric Co., Type NQOD manufactured by Square D Company, or equal.
 - b. 277/480 VAC, 3 Phase Panelboards. Unless otherwise indicated, four wire 277/480 VAC panelboards shall be: bolt-on AE Series manufactured by General Electric Co., Type NF as manufactured by Square D Company, or equal.

B. Panelboard Circuit Breakers

1. Circuit breakers, where included as part of panelboards, shall be mechanically and electrically similar to molded case circuit breakers.
2. Single pole breakers shall have a minimum interrupting rating of 10,000 amperes RMS symmetrical at 240 VAC or 14,000 amperes at 480 VAC unless otherwise shown or specified.
3. Except where otherwise shown, trip ratings shall be 20 amperes.
4. 120/208 VAC circuit breakers shall be Q Line manufactured by General Electric Co., Type QOB manufactured by Square D Company, or equal.
5. 277/480 VAC circuit breakers shall be TEY Line manufactured by General Electric Company, Type ED/EG/EJ manufactured by Square D Company or equal.
6. GFCI circuit breakers shall be provided where scheduled on the Contract

2.2 CIRCUIT BREAKERS

A. Molded Case Circuit Breakers

1. Except as modified below, the material and construction of molded case circuit breakers shall be in accordance with NEMA AB-1 and UL 489 standards for breakers.

2. Circuit breakers shall be of the air-break type.
3. Circuit breaker mechanisms shall be so designed that an overload or a fault on any one pole shall trip all poles simultaneously.
4. All poles shall be effectively barriered from one another.
5. Circuit breaker handles shall be trip-free. Circuit breakers in motor control centers or individual enclosures shall be interlocked with the door latching mechanism so that the door of the circuit breaker enclosure or motor control center compartment cannot be opened unless the circuit breaker contained is in the open position.
6. Number of poles and trip ratings of circuit breakers shall be as shown, specified, or required.
7. Motor control center main and tie circuit breakers shall be provided with auxiliary contacts for remote monitoring of the circuit breaker status.

B. Individual Circuit Breakers

1. Circuit breakers shall have a minimum of 14,000 amperes RMS symmetrical interrupting rating at 480 VAC or 10,000 amperes at 240 VAC except where different ratings are shown on the Contract Drawings, or unless otherwise specified.
2. Circuit breakers, 225 ampere frame and above, shall have interchangeable thermal and adjustable magnetic tripping elements.
3. Circuit breaker enclosures of the type shown on the drawings shall be provided.

C. Motor Circuit Protectors

1. Motor Circuit Protectors (MCP) shall have a quick make, quick break, switching mechanism, mechanically trip free from the handle, enclosed in a molded case.
2. The Contractor shall field verify actual motor starting and running currents in sizing the MCPs. Any replacement of MCPs due to this verification not being performed shall be done at no additional cost to the Contract.
3. MCPs shall have provisions for adjusting the instantaneous magnetic trip element.
4. Each pole shall provide instantaneous short circuit protection and all poles shall be constructed to open, close, and trip simultaneously.
5. Where higher short circuit protection is required, MCPs shall be provided with current limiters with trip indicators that are fully coordinated with the motor circuit protector so all three phases open if the current limiter is operated. Current limiters shall be constructed so replacement can only be made with an identical limiter having the same interrupting capacity. The minimum interrupting short circuit ratings of the MCP shall be known as shown on the Contract Drawings (integral rating).

6. MCPs shall be Type MCP manufactured by Cutler-Hammer Co., type Mag-Break manufactured by General Electric Co., or equal.

D. Service Entrance Circuit Breakers

1. Where shown or required, a service entrance breaker shall be provided to disconnect all conductors in a building or structure from the service-entrance conductors.
2. The service entrance breaker shall be UL listed, service entrance rated.
3. Where a 480 Volt System 1,000 ampere breaker or larger is shown or required, ground fault protection shall be provided in accordance with NEC 230-95.
4. The service entrance breaker shall be provided with an appropriate enclosure labeled as "Service Disconnect," and the enclosure shall be connected to the grounding grid in accordance with Section 16450 Electrical Grounding and the National Electrical Code.

2.3 SWITCHES

A. Disconnect Switches

1. Disconnect switches as indicated on the plans and specifications shall be NEMA Heavy Duty Type HD, Underwriter's Laboratories listed. The switches shall be fusible type unless otherwise indicated on the Contract Drawings.
2. Switch Interior. All switches shall have switchblades that are fully visible in the OFF position when the door is open. Switches shall have removable arc suppressors, where necessary, to permit easy access to line-side lugs. Lugs shall be UL listed for aluminum and/or copper cables and front removable. All current carrying parts shall be plated.
3. Switch Mechanism. Switches shall have a quick-make, quick-break, operating handle and mechanism, which shall be an integral part of the box, not the cover. Switches shall have interlock to prevent unauthorized opening of the switch door in the ON position or closing of switch mechanism with the door open. Handle position shall indicate if switch is ON or OFF. Switch shall be lockable in the OFF position.
4. Enclosures. Switches shall be furnished in NEMA 1 general-purpose enclosures unless specified as NEMA 3R (rainproof), NEMA 4 (stainless steel), or NEMA 7 (Class I, Div 1) on the Contract Drawings. Covers on NEMA 1 enclosures shall be attached with pin type hinges.
5. Ratings. Switches shall be rated as indicated on the Contract Drawings. The switch must have a UL listed rejection feature to reject all fuses except Class R. UL listed short circuit ratings, when equipped with Class J or Class R fuses, shall be 200,000 amperes RMS symmetrical.

B. Molded Case Switches

1. Molded case switches shall be provided where shown on the Contract Drawings. Molded case switches shall be automatic type designed to open instantaneously at a factory preset magnetic trip point. Molded case switches shall be designed for 600 VAC, 3 pole, with a minimum withstand rating of 25,000 amperes.

2. Molded case switches shall be as manufactured by Square D, or equal.

2.4 FUSES

- A. Low Voltage (less than 600 volts) cartridge fuses shall be of the voltage and amperage rating listed on the drawings. Fuses shall be selected to provide overcurrent , short circuit, and blackout protection. They shall be of the type listed below unless otherwise indicated.
 1. Main service and feeder protection (above 600 amps) – Current limiting UL Class L above 600 amperes (current UL standards do not rate Class L fuses at 600 amperes or below).
 2. Main service and feeder protection at 600 amps and below – Current limiting UL Class J.
 3. Motor branch circuit, transformer, inductive loads protection (such as MCCs, starters,etc.) – UL Class J current limiting, time delay for motor inrush and short circuit protection.
- B. Refrigeration or air-conditioning equipment. Where refrigeration or air conditioning equipment includes requirements for a particular overcurrent device type (i.e., fuse) and maximum size, this requirement shall be adhered to. If a particular type of equipment is listed for “Maximum fuse size”, a fuse must be used to protect this equipment. Refrigeration equipment will be protected with UL Class J time delay fuses.
- C. Manufacturers
 1. Bussman
 2. Littlefuse
 3. Eagle
 4. equal.
- D. Spare Fuse Cabinet. Provide Spare Fuse Cabinet Enclosure. Spare Fuse Cabinet shall be wall mounted enclosure with piano-hinge door for spare. Size adequate for storage of spare fuses with 25% spare capacity. Enclosure shall have painted finish with “SPARE FUSES” stenciled on front door. Spare Fuse Cabinet shall be Bussman, SFC, or equal.

2.5 ENCLOSURES

Enclosures for Circuit Protective Devices shall be of the type appropriate for each location as specified under Section 26 27 16 Electrical Cabinets and Enclosures.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Electrical Contractor shall refer to all pertinent Sections of these Specifications for installation details of other equipment associated with panelboards and individual circuit breakers.
- B. Provide all miscellaneous bolts, washers, nuts, clips, Belleville washers, lockwashers, small hardware, etc., of corrosion resistant material to make installation complete.
- C. Provide minimum working clearance, as described in the National Electrical Code Article 110.26, for all electrical equipment.

- D. Verify the location of each piece of equipment at the site before installing enclosures or conduits.
- E. Mount all cabinets level and plumb, flush or surface as scheduled.
- F. Install recessed cabinet flush with finished wall.
- G. Be sure wall thickness will accept panel enclosures before ordering equipment.
- H. Paint all scratches, marring, and other imperfections in the finish, resulting from installation. Use matching paint.
- I. Provide complete and professional installation for all items of equipment included in this Section, and in accordance with the National Electrical Code.

3.2 INSTALLATION OF PANELBOARDS

- A. Mount panelboards 6'-6" minimum to centerline to top circuit breakers; 3'-0" to bottom of cabinet where possible, unless noted otherwise.
- B. Properly align panel in cabinet.
- C. Provide for empty 1-inch conduits from panel to ceiling space for all flush mounted panels. Arrange for future continuation of work.

3.3 FUSES

- A. Install fuses in fusible devices as shown. Arrange fuses such that fuse ratings may be read without removing the fuse.
- B. Install spare fuse cabinet with spare fuses in location shown (or adjacent to distribution switchgear).
- C. Spare Fuses. Furnish quantity equal to 20 percent of each type and six installed, but not less than one set of three of each of type and size.

**** End of Section ****

SECTION 26 29 13 MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

This Section includes motor controllers for the three-phase and single-phase motors operating at voltages not in excess of 600 VAC.

1.2 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revision of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Underwriters Laboratories (UL)
 - 4. International Electrotechnical Commission (IEC)
- B. Qualifications of manufacturer. Provide materials and equipment that are the products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.
- C. Uniformity: Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material. Solid state motor controllers, AC magnetic contactors, NEMA rated overloads, and molded case circuit breakers for motor circuit shall be of the same manufacturer.

1.3 SUBMITTALS

- A. Submittals shall conform to the requirements given in Section 26 00 00 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference.
- B. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications, associated standards and test requirements.
- C. Prior to obtaining any material in connection with this section, catalog data and detailed wiring connection diagrams shall be submitted. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings,

circuit diagrams, and dimensional data, as a minimum. Drawings shall include elementary and interconnection diagrams showing connections to internal components, and indicate field termination points for power and control interface. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted.

- D. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly and section views, and all necessary details pertaining to coordinating the work of the Contract, lists of materials and finishes, parts list and the descriptions thereof, lists of spare parts and tools where such parts or tools are required, and any other information that is required to demonstrate compliance with the Contract Documents. Drawings for electrical equipment shall include elementary and interconnection diagrams showing connections to internal components, and indicating field termination points for power and control interface. Solid State Motor Controller Equipment supplier shall submit manufacturer's catalog data and diagrams, output cable lug sizes and ratings, and elevation view of Solid State Motor Controller with the door removed. Project specific wiring diagrams shall be provided.
- E. Submittal shall contain manufacturer's descriptive data including ratings, circuit diagrams, dimensional data, conduit entry restrictions, and heat dissipation to ambient. Submittals shall also contain manufacturer's part number for the equipment.
- F. Solid State Motor Controller Supplier shall submit maximum input current rating of the Solid State Motor Controller at the applicable utilization voltage (480VAC or 208VAC), maximum output current rating, rating and size of input circuit protective device, and short circuit rating of equipment. Solid State Motor Controller Supplier shall also submit actual nameplate information for each controller.
- G. Manufacturer's standard wiring diagrams and specific modifications to the wiring of the equipment shall be submitted. All terminal points for field, and interconnecting wiring shall be identified.
- H. Submittals shall include a list of the setup parameters for the solid state motor controller.
- I. Samples of any material shall be submitted upon Engineer's request.

1.4 CLOSEOUT SUBMITTALS

Provide project record documents which record actual circuit directories, as well as actual locations of components and circuits.

PART 2 PRODUCT

2.1 NEMA MAGNETIC MOTOR CONTROLLERS

A. NEMA Magnetic Motor Starters

- 1. Magnetic motor starters shall be 3-pole, 60 cycle magnetic starters, and shall be of the NEMA size appropriate for the motor horsepower and voltage shown but not be less than NEMA Size 1.

2. Unless otherwise specifically shown or specified, all magnetic motor starters shall be provided with:
 - a. Vertical lift operation.
 - b. A replaceable type, encapsulated operating coil rated at 120 VAC.
 - c. Overload relays.
 - d. Starter coils and contacts shall be easily replaceable without removing contactor from the enclosure.
3. Magnetic motor starters shall be rated to meet minimum number of load/life operations (contact electrical life under load) when motor starter is used for starting of squirrel cage motors and switching motor off only after the motor is up to speed, as follows:

<u>NEMA Size</u>	<u># of Operations</u>	<u>Operational Current</u>
1	2 million	27 amperes
2	2 million	45 amperes
3	1.5 million	90 amperes
4	1.5 million	135 amperes
5	2 million	270 amperes

4. Individual magnetic motor starters shall be provided with the required accessories to perform the control circuit as shown on Contract Drawings or specified. These accessories shall include but shall not be limited to the following:
 - a. Single-phase control transformers of rating suitable for the load of the control circuit as actually installed, with fused secondary rated for 120 VAC.
 - b. Pushbutton stations or selector switches with legend plates or engraved nameplates as specified in Section 260916 Miscellaneous Electrical Controls.
 - c. Hand-Off-Auto selector switch, unless otherwise noted.
 - d. Push-to-test indicating lights with interchangeable covers as specified in Section 16902 Miscellaneous Electrical Controls.
 - e. Control circuit fuse where a separate control circuit is shown.
 - f. Two electrically convertible contact interlocks.
5. Each magnetic motor starter shall be of a type suitable to perform the control function shown and be in accordance with one of the following:
 - a. Constant Speed, Full Voltage, Non-Reversing Starters (FVNR) shall provide basic contactors for forward control.
 - b. Constant Speed, Full Voltage Reversing Starters (FVR) shall provide basic contactors for the forward and reverse speed. Mechanical and electrical interlocks shall be provided to preclude the possibility of both contactors being closed at the same time.
 - c. Constant Speed, Reduced Voltage Starters (RV) shall be of the closed transition, auto-transformer type and shall include the required 3 pole and 5 pole contactors, auto-transformers, timing relays and appurtenances.
 - d. Multi-Speed Motor Starters shall provide the basic contactors for each speed, suitable interlocked. Where shown, sequence-compelling relays shall be provided.
6. Magnetic motor starter manufacturers:

- a. Allen-Bradley Bulletin 500, 505 Series
- b. General Electric CR-306, CR-309 Series
- c. Sq D Class 8536, 8702 Series
- d. Cutler-Hammer A-200 Series, A-210 Series
- e. equal (Samples of equal products shall be submitted in accordance with Part I)

B. NEMA Combination Motor Starter with Circuit Breaker (MCP) Disconnect

- 1. Combination magnetic motor starters shall be the combination type consisting of a motor circuit protector (MCP) and NEMA magnetic motor starter assembled and wired into a self-contained unit.
- 2. The magnetic motor starter shall be designed to coordinate with the circuit protective device to withstand a minimum short circuit current of 22,000 AIC or as shown on the Contract Drawings.
- 3. MCP and magnetic motor starter shall be packaged by one manufacturer. Combination motor starters shall be:
 - a. Allen-Bradley Bulletin 513, 507 Series
 - b. General Electric Type CR387, CR390 Series
 - c. Sq D Class 8539, 8739 Series
 - d. Cutler-Hammer Class A206, A216 Series
 - e. equal (Samples of equal products shall be submitted in accordance with Part I)
- 4. Disconnect switch shall be capable of being locked in the open position.

C. NEMA Combination Magnetic Motor Starter with Fused Switch Disconnect

- 1. Combination magnetic motor starters shall be the combination type consisting of a fused switch and NEMA magnetic motor starter assembled and wired into a self-contained unit.
- 2. The magnetic motor starter shall be designed to coordinate with the fused switch to withstand a minimum short circuit current of 100,000 AIC or as shown on the Contract drawings.
- 3. Fused switches shall be provided with Class R fuse clips.
- 4. Fused type combination starter shall be provided certified Type 2 coordination in accordance with IEC 947-4-1.
- 5. Fused switch and magnetic motor starter shall be packaged by one manufacturer. Combination motor starters shall be:
 - a. Allen-Bradley Bulletin 512, 506 Series
 - b. General Electric Type CR308, CR311 Series
 - c. Sq D Class 8538, 8738 Series
 - d. Cutler-Hammer Class A204, A214 Series
 - e. equal (Samples of equal products shall be submitted in accordance with Part I)

D. NEMA Manual Motor Starting Switches

1. Manual motor starting switches shall be provided for the control and protection of all single-phase motors which do not require control from a remote location.
2. Manual motor starting switches shall provide thermal overload protection, including trip-free operation, and a manual reset overload.
3. Integral start-stop pushbuttons or on-off toggle switches shall be provided as shown on the Contract Drawings.
4. Manual motor starting switch manufacturers:
 - a. Allen-Bradley Bulletin 600 Series
 - b. General Electric CR101, CR1062
 - c. Sq D Class 2510, 2511, 2512
 - d. equal (Samples of equal products shall be submitted in accordance with part I)

E. NEMA Overloads

1. The Contractor shall verify the ratings of overloads and install overloads suitable for the actual motors installed, and based on the actual nameplate information and other supplemental information furnished with the installed motors. Thermal overload units shall be selected on the basis of motor nameplate full-load current and service factor. Thermal overload unit sizes originally selected on an approximate basis shall be rechecked and corrected at the time or installation. Any replacement of motor overloads due to this verification not being performed shall be done at no additional cost to Owner.
2. Overload relays shall be class 20, manual reset, eutectic alloy, thermal type overload device with visual trip indication, unless shown or specified otherwise. Overload relays shall be current transformer operated if required for coordination.
3. Three spare overload relay thermal elements shall be provided for each type of element installed.
5. Overload relay manufacturers:
 - a. Allen-Bradley Bulletin 592
 - b. General Electric CR324
 - c. Square D Class 9065
 - d. equal (Samples of equal products shall be submitted in accordance with part I)

2.2 IEC MAGNETIC MOTOR CONTROLLERS

A. IEC Magnetic Motor Starters

1. Magnetic motor starters shall be 3 pole, 60 cycle magnetic starters rated for IEC utilization category AC3 and be of the IEC size appropriate for the motor horsepower and voltage shown but not rated less than AC3 - 18 amperes, 2 million operations.
2. Magnetic motor starters shall be rated to meet minimum mechanical endurance (number of no load operating cycles) per IEC 947-4:

Mechanical Operations

Electrical Size

20 million operations	18 amperes
20 million operations	24 amperes
15 million operations	30 amperes
15 million operations	38 amperes
15 million operations	45 amperes
15 million operations	60 amperes
15 million operations	75 amperes
10 million operations	110 amperes
10 million operations	180 amperes

3. Magnetic motor starters shall be provided with interchangeable contacts that may be easily inspected, for applications greater than 25 HP.
4. Magnetic motor starters shall be provided with an operating coil rated at 120 VAC, common through 20 HP, slide out type for above 20 HP.
5. Individual magnetic motor starters shall be provided with the required accessories to perform the control requirements specified or as shown on Contract Drawings. These accessories shall include, but not be limited to the following:
 - a. Single-phase control transformers of ratings suitable for the load of the control circuit as actually installed with fused secondary rated at 120 VAC.
 - b. Pushbutton stations or selector switches with legend plates or engraved nameplates as specified in the Section 16902 Miscellaneous Electrical Controls.
 - c. Hand-Off-Auto selector switch, unless otherwise noted.
 - d. Push-to-test indicating lights with interchangeable covers as specified in the Section 16902 Miscellaneous Electrical Controls.
 - e. Control circuit fuse where a separate control circuit is shown.
 - f. Two extra electrical convertible contact interlocks.
6. Each magnetic motor shall be a type suitable to perform the control function shown and in accordance with the following:
 - a. Constant Speed, Full Voltage, Non-Reversing (FVNR) Starters shall provide basic contactors for forward control.
 - b. Constant Speed, Full Voltage, Reversing (FVR) Starters shall provide basic contactors for forward and reverse control. Mechanical and electrical interlocks shall be provided to preclude the possibility of both contactors being closed at the same time.
7. Each IEC combination type magnetic motor starter with fused switch disconnect shall provide verified Type 2 coordination in accordance with IEC 947-4-1.
8. Magnetic motor starters shall be suitable for group installation in accordance with the NEC 430-53.

9. Magnetic motor starter manufacturers:
 - a. Allen-Bradley Bulletin 100, 104 Series
 - b. Klockner Moeller DIL-M, DIUL-M Series
 - c. Square D Telemecanique Type D and F
 - d. equal (Samples of equal products shall be submitted in accordance with Part I)

B. IEC Combination Magnetic Motor Starter with Circuit Breaker (MCP) Disconnect

1. Combination magnetic motor starters shall consist of a motor circuit protector (MCP) and IEC motor starter assembled and wired into a self-contained unit.
2. The magnetic motor starter shall be designed to coordinate with the circuit protective device to withstand a minimum short circuit current of 22,000 AIC or as shown on the Contract Drawings.
3. Circuit protective devices shall be motor circuit protectors or as shown on the Contract Drawings and shall be in accordance with Section 16470 Panelboards and Circuit Protective Devices.
4. MCP and magnetic motor starter shall be packaged by one manufacturer. Combination starters shall be:
 - a. Allen-Bradley Bulletin 113
 - b. Klockner Moeller type NZM
 - c. Square D Telemecanique Type LE1
 - d. equal (Samples of equal products shall be submitted in accordance with Part 1.)

C. IEC Combination Magnetic Motor Starter with Fuse Switch Disconnect.

1. Combination type starters shall consist of a fused switch and motor starter assembled and wired into a self-contained unit.
2. The magnetic motor starter shall be designed to coordinate with the fused switch to withstand a minimum short circuit current of 100,000 AIC or as shown on the Contract Drawing.
3. Fused switches shall be provided with fuse clips to accommodate UL Class J and CSA HRC1-J fuses or as shown on the Contract Drawings. The switch shall be rated for IEC utilization category AC23 and be of the IEC size appropriate for the motor horsepower and voltage shown but not rated less than AC23-30 amperes.
4. Fused type combination starter shall provide verified Type 2 coordination in accordance with IEC 947-4-1.
5. Fused switch and starter shall be packaged by one manufacturer. Combination starters shall be:
 - a. Allen-Bradley Bulletin 512
 - b. Klockner Moeller Type P2
 - c. Square D Telemecanique Type LE1
 - d. equal (Samples of equal products shall be submitted in accordance with Part 1)

D. IEC Manual Motor Starting Switch

1. Manual motor starting switches shall be provided for control and protection of all single-phase motors which do not require control from a remote location.
2. Manual starting switches shall provide thermal overload protection, including trip free operation and manual reset on overload.
3. The overload mechanism shall be class 10 ambient compensated bimetal type and shall include a differential mechanism for sensitivity to single phase conditions.
4. Integral start-stop pushbuttons or on-off toggle switches shall be provided.
5. IEC manual motor starting switch manufacturers:
 - a. Allen-Bradley Bulletin 140 Series
 - b. General Electric CR72 Series
 - c. Square D GV1, GV3 series

E. IEC Overload Relays

1. The contractor shall verify the ratings of the overload relay units in accordance with actual motor nameplates or other information furnished with the installed motors. Any replacement of overload relays due to this verification not being performed shall be done at no additional cost to the Contract.
2. Overload relay shall be class 10 ambient compensated bimetal type with integral heater elements and shall include a differential mechanism for sensitivity to single phase conditions.
3. Overload relays shall be provided with external hand reset mechanism and visible trip indication.
4. Three spare overload relay thermal elements shall be provided for each type element installed.

2.3 CAPACITORS

- A. Capacitors shall be of the size scheduled and/or shown on the Contract Documents and based on motor nameplate data.
- B. The total kilo-var rating of the capacitors that are connected to the load side of a motor controller shall not exceed the value required to raise the no-load power factor of the motor to unity.
- C. All motors 20 HP and larger shall have 3 phase power factor correction capacitors installed with them. The capacitors shall be rated for 480 VAC, 60 Hertz.
- D. The capacitor shall be connected to the load side of the motor starter so that they cycle on and off the line with the motor.
- E. Provide termination lugs at starter compartment in the connection between contactor and thermal overload for connection of capacitors in parallel with motor.

- F. Capacitors are to be rated for indoor service and are to be supplied with manufacturer's mounting brackets for mounting on wall, ceiling, or floor as specified, scheduled, and/or shown on the Contract Documents.
- G. Capacitors are to be provided with internal discharge resistors to drain the residual charge on the capacitors so that the voltage diminishes to less than 50 volts within one minute after the circuit is de-energized.
- H. Capacitors are to be provided with internal current limiting fuses.
- I. Capacitors will be provided with non-PCB impregnant.
- J. Locate capacitors near the equipment, and verify that the location will not interfere with equipment operation access.
- K. Conductors shall be sized not less than 135% of the rated current of the capacitor or not less than 1/3 motor conductor size, whichever is greater, in accordance with the national Electrical Code. All conductors shall be installed in conduit.
- L. Manufacturers: Cutler- Hammer, General Electric, Sprague, or equal.

PART 3 EXECUTION

3.1 MARKING ON MOTOR CONTROLLERS

- A. A motor controller shall be marked with the manufacturer's name or identification, the voltage, the current or horsepower rating, the short-circuit current rating, and other necessary data to properly indicate the applications for which it is suitable.

3.2 INSTALLATION

- A. Overload relays shall be installed in each leg of the starter.
 - 1. Overload relay characteristics shall be closely parallel the motor thermal characteristics.
 - 2. Ambient compensated overload relay thermal elements shall be installed where motor and overload are in different locations.
- B. Enclosures for motor controllers shall be of the type appropriate for each location, as specified in Section 16160 Enclosures.

3.3 FIELD QUALITY CONTROL

- A. Adjust the motor overloads to match the nameplate currents of the motors that they are protecting.
- B. Inspection and Field Calibration (includes Reduced Voltage Solid State Motor Starter Testing)
 - 1. The services of a qualified manufacturer's engineer shall be provided to inspect and calibrate the solid state reduced voltage (SSRV) starters. Services shall consist of a minimum of six (6) 8-hour days of on-site service and supervision. The manufacturer's engineer shall perform

services simultaneous with start-up and testing of process mechanical equipment being powered from SSRV starters. The manufacturer's engineer shall perform the following services:

- a. Visually inspect delivered units and accessories for conformance with the specifications and Contract Drawings.
- b. Examine equipment locations for satisfactory preparation. Check conduits and raceway installations, and all wiring and cable terminations.
- c. Start-up of SSRV equipment shall be performed under technical direction of manufacturer's service engineer. Under no circumstances shall any portion of the equipment be energized without authorization from the manufacturer's service engineer.
- d. Manufacturer's service engineer shall program and calibrate each unit. Submit a startup configuration/parameter report for each drive. Report shall include the following information as a minimum:
 - i. Project Name
 - ii. Drive Location
 - iii. References
 - iv. Tag Reference
 - v. Manufacturer/Model
 - vi. Manufacturer Serial Number
 - vii. Test Equipment Type and ID Number
 - viii. Date and Time Calibrated
 - ix. Configuration By: (name of person)
 - x. Detailed configuration/parameter settings

**** End of Section ****

SECTION 26 29 23
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

This Section describes materials, testing and installation of variable frequency drives (VFDs) for low voltage motor applications, for motors 1/4HP -5HP.

1.2 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revision of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Underwriters Laboratories (UL)
 - 4. International Electrotechnical Commission (IEC)
- B. Manufacturer's Qualifications. Provide materials and equipment that are the products of manufacturers regularly engaged in the production variable frequency drives. The manufacturer shall have a minimum of five (5) years experience in the design and manufacture of Variable Frequency Drives. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.
- C. Uniformity. Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.

1.3 SUBMITTALS

- A. Shop Drawings
 - 1. Submittals shall conform to the requirements given in Section 26 00 00 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference.
 - 2. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications, associated standards and test requirements.
 - 3. Prior to obtaining any material in connection with this section, catalog data and detailed wiring connection diagrams shall be submitted. Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets.

4. Submittal shall include ratings, circuit diagrams, and dimensional data, as a minimum. Drawings shall include elementary and interconnection diagrams showing connections to internal components, and indicate field termination points for power and control interface. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted.
5. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly and section views, and all necessary details pertaining to coordinating the work of the Contract, lists of materials and finishes, parts list and the descriptions thereof, lists of spare parts and tools where such parts or tools are required, and any other information that is required to demonstrate compliance with the Contract Documents. Drawings for electrical equipment shall include elementary and interconnection diagrams showing connections to internal components, and indicating field termination points for power and control interface. VFD equipment supplier shall submit manufacturer's catalog data and diagrams for incoming cable connections, input and output cable lug sizes and ratings, and elevation view of VFD with the door removed. Project specific wiring diagrams shall be provided.
6. VFD supplier shall submit manufacturer's descriptive data including ratings, circuit diagrams, dimensional data, conduit entry restrictions, and heat dissipation to ambient.
7. VFD supplier shall submit maximum input current rating of VFD at utilization voltage of 480VAC, maximum output current rating of VFD, rating/size of input circuit protective device, and short circuit rating of equipment.
8. VFD supplier shall submit detailed shop drawings of all materials prior to obtaining any material in connection with this section. Based on the information in the catalog literature provided, submittal shall include the complete part number for the VFD, and an explanation describing how the features included with the VFD are indicated by the part number.
9. VFD supplier shall submit certification of completed and approved factory test and provide test results.
10. VFD supplier shall submit software documentation manual for the drives.

B. Operations and Maintenance Manuals

1. Manuals shall include operation and maintenance information on all items of the equipment. The following data shall also be included as a minimum:
 - a. Title page giving name and location of facility.
 - b. List of equipment furnished with complete part numbers along with name, address, and telephone number of vendor.
 - c. List of serial numbers.
 - d. Project specific elementary and interconnection diagrams showing power and control connections to internal and remote field devices.
 - e. Latest approved shop drawings corrected to as-built conditions.
 - f. Spare Parts List (including specified spare parts to be furnished by the Contractor and manufacturer's recommended spare parts list for each drive).
 - g. Manufacturer's data sheets and dimension drawings of each piece of equipment, and details of all replacement parts.

- h. Complete listing of nameplate data.
 - i. Information within the manuals shall be clearly labeled to identify components applicable to the project. Non-applicable information shall be noted, or neatly crossed-out within the manuals.
 - j. Final drive configuration and parameter settings.
 - k. Software documentation manual and project specific program documentation
2. All items listed above that are of a sheet size of 8-1/2 inches by 11 inches or can be folded (no more than twice) to this size shall be bound in loose-leaf three-ring type binders with black plastic-coated or blue canvas covers. The contents shall be fully indexed. Shop Drawings 24 inches by 36 inches in size shall be folded to approximately 12 inches by 9 inches with drawing title box exposed along either edge. Shop Drawings descriptive of a single item of equipment shall be grouped together. All shop drawings shall be placed in sheet protectors (9-1/2 inches x 14-3/4 inches).
3. All shop drawings included in the binders and/or folders shall be those copies previously submitted for review and approval and shall bear the Engineer's stamp of approval and comments as originally noted thereon.
4. Acceptance or beneficial occupancy will positively not be undertaken until approved Operation and Maintenance Manuals have been submitted. Partial approvals of the final manual will not be made.
5. Delivery of Operations and Maintenance (O&M) Manuals and installation instructions, satisfactory to the Engineer, are an essential part of the equipment delivery and prerequisite to approval of final payment on the delivery of that equipment. Incomplete or inadequate manuals will be returned to the Contractor for correction and/or resubmission.

PART 2 PRODUCT

2.1 GENERAL

- A. The Variable Frequency Drive (VFD) shall convert the input alternating current (AC) main power to an adjustable frequency and voltage capable of operating the designated motor. VFD shall consist of the solid state electronic power conversion devices and circuitry and the control circuitry.
- A. Each drive shall operate as a simplex unit with no interaction with other drives. Horsepower rating and current rating of each drive shall be sufficient to drive the designated motor, and provide sufficient torque to start and operate the motor for the entire range of speeds, up to and including the rated speed.
- B. Equipment shall comply with the requirements of ANSI, IEEE, and NEMA. The electrical equipment, design, and construction shall comply with the provisions of the NEC.
- C. The complete VFD assembly shall be "Integrally Equipment Rated" in accordance with UL requirements and shall be suitable for withstanding and interrupting an available fault of 100,000 RMS symmetrical amperes minimum at 480VAC. Input circuit breaker shall be molded case, thermal magnetic type rated for use with the utilization voltage, and shall be sized in accordance with the requirements of the NEC. Circuit breaker shall be a standard type and shall be as specified in section 26 28 00. Short circuit and ground fault protective devices for the motor

branch circuit for the VFD shall be provided in accordance with the requirements of the NEC. Provide disconnect that is capable of being locked in the Off position, from the front of the cabinet. Disconnect switch shall remove all power to the enclosure.

- D. The VFD shall comply with IEEE 519-1992 entitled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems". The point of common coupling for this application shall be the MCC bus. VFD shall be provided with 3% or 5% line reactors if necessary to reduce noise. In addition, provide harmonic filters or other devices as required to meet these requirements. Provide load side reactors or common mode chokes at the output of VFD. The line reactors or chokes shall be installed on the line side of the inverter. Reactors or chokes shall be factory mounted and housed within the VFD enclosure.
- E. Variable frequency drives shall be Allen Bradley PowerFlex 4 Drive, or equal.

2.2 VARIABLE FREQUENCY DRIVES

- A. Drive shall be variable voltage/variable frequency type using constant volts per hertz ratio for its power output.
- B. The power conversion bridge shall consist of a three-phase diode bridge or controlled rectifier circuits to convert the incoming AC input power to DC intermediate power.
- C. The inverter switching circuit shall use the latest insulated-gate bipolar power transistor (IGBT) technology to convert the DC intermediate power to sinusoidal AC power.
- D. The drive shall be designed to modify the applied voltage to the motor whenever the frequency is changed in order to deliver the rated torque to the motor. The drive controller circuitry shall use pulse-width modulation (PWM) to adjust the voltage to the motor.
- E. Equipment shall be designed to operate under the following conditions:
 - 1. Altitude: 1,000 meters (3,300 feet) above sea level.
 - 2. Storage ambient temperature range: -40° C to 85° C (-40° F to 185° F).
 - 3. Operating ambient temperature range: -20° C to 50° C (-4° F to 122° F).
 - 4. Relative humidity: 0% to 95%, non-condensing
 - 5. Shock: 15G peak for 11msec duration
 - 6. Vibration: 0.152 mm (0.006 inches) displacement, 1G peak
 - 7. Input voltage: 380 to 460VAC +/- 10%, 3 phase
 - 8. Input frequency: 50/60Hz, +/- 6%
 - 9. Input power factor: 0.98 or better.
 - 10. Output voltage: 0 to 100% rated input voltage, 3 phase.
 - 11. Output frequency: 0 to 60Hz.
 - 12. Overload rating of 1.1 times rated current for 60 seconds
- F. Drive ratings:
 - 1. Input voltage - 480 VAC, 3-phase, 3 wire, 60-Hz
 - 2. Output to motor load - 480 VAC, 3-phase, 3-wire, output power for the motor load
 - 3. Current overload rating – 110% of rated current for 60 seconds
 - 4. Starting torque – 150% at 1 Hz
 - 5. Speed regulation – 2%

- G. The variable frequency drive system shall provide class 10 motor overload for the connected motor.
- H. The variable frequency drive system shall be designed to provide protection against the following conditions:
 - 1. Phase to phase short circuit
 - 2. Ground fault
 - 3. Under-voltage and over-voltage
 - 4. Load loss
- I. The drive controller shall include protective circuitry that initiates an orderly shutdown of the inverter without component failure. The controller shall shut down and require manual reset for the following fault conditions:
 - 1. Overload.
 - 2. Instantaneous overcurrent.
 - 3. Inverter fault.
 - 4. Overfrequency.
 - 5. D-C link overvoltage.
- J. The drive controller shall be capable of detecting the fault conditions described below.
 - 1. Incorrect phase sequence.
 - 2. Loss of an input phase.
 - 3. Input undervoltage.
 - 4. Input overvoltage.
 - 5. Ground fault
 - 6. Phase to phase short circuit
 - 7. Loss of load

2.3 CONTROLS

- A. The controller shall include the following features:
 - 1. 0 to 65 Hz continuous operating range, with 0.01 Hz frequency resolution.
 - 2. Output current limit, adjustable to limit motor inrush current during startup.
 - 3. Adjustable acceleration and deceleration rates.
 - 4. Maximum and minimum speed adjustments.
 - 5. Frequency skip adjustment (3 minimum).
 - 6. Input terminals for start/stop control using dry contact input from standard industrial type relays.
 - 7. Input terminals for remote speed control input.
 - 8. Provide an isolated common dry contact for remote indication of a VFD fault condition detected by the VFD.
- B. The following data shall be accessible via a digital display and keypad mounted on the control cabinet door.
 - 1. Control power on.
 - 2. Drive Run
 - 3. Drive Fault
 - 4. Drive speed, 0% to 100% rpm, and 0-60 Hz.
 - 5. Drive output current and voltage.
 - 6. System mode, Local/Remote.
 - 7. Manual speed adjustment, 0-100% rpm and 0-60 Hz.

8. Drive, start/stop (Local mode).
- C. Local Mode via Keypad
 1. Stop/Start of drive based on operator input at VFD via keypad.
 2. Speed control of drive based on operator input at VFD keypad or input via door mounted potentiometer. Provide selector switch on the interior of the enclosure to select between potentiometer of VFD keypad speed control.
- D. Remote Mode
 1. Capability for Start/Stop via dry contact input.
 2. Speed control via 4-20 mA input signal from existing Main Control Panel. VFD speed shall vary between minimum and maximum speed proportional to the 4-20 mA input signal. VFD shall shut down if signal is outside the 4-20 mA range. Minimum and maximum speeds shall be determined by the County in the field.
 3. Provide an operator adjustable time delay setting that the VFD shall continue running the pump motor (and allow it to go through normal shutdown sequence) in the event of a pump failure.
- E. Provide capability for five discrete input connections: Start, Run Enable (future), Override (future), and two spares. Provide capability for four relay output contacts: VFD Run, VFD Fail, and two programmable spares. Provide one 4-20 mA analog input connection for remote speed control, and one analog output, 4-20 mA, for speed indication in VFD mode. The discrete inputs, relay outputs and analog input shall be programmable via the VFD keypad (except bypass run), using the digital display as the operator interface.

2.8 FACTORY TESTING

VFD shall be subjected to a rated motor load operational test prior to shipment. Provide written certification of completed and approved factory test.

1.9 SOFTWARE

Provide all configuration software and cables for connection of drive to a laptop computer for setting the drive parameters. Configure all drive parameters to operate as specified. Software shall be licensed to Worcester County. The permanent software license and cabling shall then be provided to the County after project completion.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Drives shall be installed as shown on the Contract Drawings. Mount drives with the recommended clearances per the manufacturer.
- B. Control signal circuits shall not run parallel to motor cables, or unfiltered supply cables with a spacing less than 1 foot. Cable tray metal dividers or separate conduit shall be used.

3.2 PRELIMINARY INSPECTION/TEST

- A. Test the operation of each interlock to verify that each interlock performs its function.

- B. The variable speed drive system shall be tested to check correct operation of each drive in the Local VFD mode, Local bypass mode, and Remote VFD mode and Remote bypass mode.
- C. Test the operation of the VFD and motor combination. Each motor shall be tested at minimum speed, maximum speed, and two equally spaced points between the minimum and maximum operating speeds.
- D. Test the total demand distortion and odd harmonic distortion of the system at the point of common coupling, in accordance with the requirements of IEEE 519, 1992, and at the VFD enclosure power input terminals. The Contractor shall provide all equipment required to test the system. A certified test report shall be submitted by the Contractor for review and approval by the County.

3.3 FINAL INSPECTION/TEST

A certified factory start-up shall be provided for each VFD provided.

**** End of Section ****

SECTION 26 51 00
LIGHTING

PART 1 GENERAL

1.1 SUMMARY

This Section includes fixtures, lamps, and accessories required for a complete installation as shown and specified.

1.2 QUALITY ASSURANCE

- A. Material and installation shall be in accordance with the latest revision of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. National Electrical Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Underwriters Laboratories (UL)
 - 4. American National Standard Institute (ANSI)
- B. Qualifications of manufacturer. Provide materials and equipment that are the products of manufacturers regularly engaged in the production of such products which are of equal material, design, and workmanship. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer.
- C. Uniformity: Unless otherwise specified, equipment or material of the same type of classification, used for the same purpose shall be the product of the same manufacturer. All material shall be new and of the current design of the manufacturer providing equipment or material.

1.3 SUBMITTALS

- A. Submittals shall conform to the requirements of Section 01 33 00 Submittals, and to the requirements given in Section 26 00 00 Electrical General. In addition, submittals shall include the manufacturer's name, trade name, place of manufacturer, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference.
- B. Prior to obtaining any material in connection with this Section, detailed shop drawings on all material shall be submitted.
- C. Submittals shall contain a material list with manufacturer's name and data describing the material and showing its compliance with specifications, associated standards and test requirements.
- D. Prior to obtaining any material in connection with this section, catalog data and detailed wiring connection diagrams shall be submitted. Submittals for each manufactured item shall be current

manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog data sheets. Submittal shall include ratings, circuit diagrams, and dimensional data, as a minimum. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted.

- E. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly and section views, and all necessary details pertaining to coordinating the work of the Contract, lists of materials and finishes, parts list and the descriptions thereof.
- F. Photometric data for fixtures shall be submitted upon Engineer's request .
- G. Samples of any material shall be submitted upon Engineer's request.

1.4 CLOSEOUT SUBMITTALS

Provide project record documents which record actual circuit directories, as well as actual locations of components and circuits.

PART 2 PRODUCT

2.1 GENERAL

- A. Unless otherwise shown or specified, all conductors shall be stranded copper.
- B. Lighting fixtures shall be provided with required hangers, mounting brackets, and hardware for installation in the location shown on the Contract Drawings.
- C. Provide low-temperature ballasts with minimum starting temperature of 0°F for all fixtures to be mounted outdoors. Energy-Saving Magnetic Ballasts: Full-light-output type, compatible with energy-saving lamps specified.
- D. Light fixtures shall be furnished as shown.
- E. Reflectors, reflector cones and visible trim of all lighting fixtures shall not be installed until completion of plastering, ceiling tile work, painting and general cleanup. They shall be carefully handled to avoid scratching or fingerprinting and shall be, at time of acceptance by Owner, completely clean.
- F. Adjustable fixtures shall be capable of being locked in position.
- G. Unpainted fixture parts shall be either anodized aluminum, non-corrosive grade stainless steel or an acceptable equivalent of non-corrosive material.
- H. Lamps shall be provided for all fixtures specified. The Contractor shall be responsible for all lamps broken or removed up to the date of acceptance of work.

2.2 FIXTURES

- A. Building Wall Mounted Wall-Packette (Type W1)

1. General: For perimeter area illumination in parking areas, public spaces, equipment areas, walkways, tunnels, building perimeters, or similar locations.
 2. Light source: LED (Light Emitting Diode).
 3. Light Output: 3,000 lumens with color temperature 4000K.
 4. Distribution: Symmetric
 5. Voltage: 277VAC
 6. Housing: Die-cast aluminum, housing integral driver and LEDs, sprung latch assembly exerts uniform pressure on gasket all around ensuring IP65.
 7. Finish: Zinc-infused Super Durable TGIC thermoset powder coat finish, resistance to corrosion and weathering. Minimum of 3 mils thickness for finish.
 8. Optical System: Acrylic lens.
 9. Listings: IP66 rated for protection against moisture and environmental contaminants.
 10. Mounting: Wall mounted.
 11. Manufacturer: Holophane – WallConnect LED, or equal.
- B. High Bay Area (Type P1)
1. General: For interior or exterior area illumination in installations where moisture, dirt, dust, vibration, corrosion, and rough usage are problems. Also for applications requiring light fixtures suitable for Class I Division 2 Hazardous (Classified) Locations.
 2. Light Source: Light Emitting Diodes
 3. Voltage: 277VAC
 4. Temperature: -40°C to 40°C ambient temperature.
 5. Housing: Cast aluminum housing.
 6. Optical System: Prismatic borosilicate glass to direct light where needed and reduce glare.
 7. Listings: UL listed for use in wet locations.
 8. Manufacturer: Holophane Petrolux LED, or equal.
- C. Emergency Lighting Unit/Exit Sign combination unit (Type E1)
1. General: Emergency lighting unit and exit sign combination unit for use in industrial and wet environments.
 2. Light Source: Green direct view LEDs for the exit sign illumination, and two halogen sealed beam lamps for the emergency lighting.
 3. Voltage: 120/277 VAC dual voltage
 4. Housing: Fiberglass reinforced polyester enclosure with a clear polycarbonate lens cover. Lens shall provide a watertight fit and be impact resistant. Housing shall be rated for use in NEMA 3, NEMA 3R, NEMA 4, NEMA 4x, NEMA 12, and NEMA 13 areas
 5. Batteries: maintenance free sealed nickel cadmium to provide 90 minutes of operation, 10 years expected operating life.
 6. Charger: Unit shall utilize a constant current charging system. The charging system shall maintain the battery at full capacity.
 7. Listings: UL listed for use in wet locations.
 8. Manufacturer: Holophane LNM – DeLeon, or equal
- D. Exit Light (Type E2)
1. General: Exit sign with superior illumination and low energy consumption.
 2. Light Source: Low energy consumption LED lamps. Lamp assembly shall be double fa
 3. Voltage: 120/277 VAC dual voltage
 4. Construction: Precision-molded, die-cast aluminum.
 5. Listings: UL listed for damp locations. Meets the requirements of UL 924 and NFPA 101.

- 6. Mounting: top, end, or back
- 7. Manufacturer: Lithonia LE or equal

2.3 SUPPORT SYSTEMS

- A. Support systems shall be provided with clamping nuts, square washers, splice plates, and hardware to assemble the system.
- B. Hangers. Lighting fixtures shall be provided with required hangers and mounting brackets for installation in the locations shown on the Contract Drawings. Mounting brackets and supports shall be heavy duty channel constructed or strip steel with a hot dipped finish per ASTM A-123. Support system shall be designed to carry the required lighting fixture load with a safety factor of 10. Provide extra steel for supports to achieve this safety factor. Hangers and accessories shall be as manufactured by: Grinnell – Powerstrut, Globe Strut – Metal Framing Systems, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Mounting height for fixtures shall be as shown on the Contract Drawings. Where no mounting height is shown, fixtures shall be mounted so as to give the minimum of shading from pipes, beams and other obstructions, but in no case less than approximately 10'-0" above the finished floor unless a lower ceiling height is specified. Where pendent type fixtures are required, they shall be suspended by means of 3/4-inch, galvanized conduit stems and ball hangers from outlet boxes or as detailed on the drawings. Check and verify field conditions to insure against mechanical or structural interference. Provide nighttime adjustment of all adjustable lighting units and floodlighting, as required, to satisfaction of Engineer.
- B. The contractor shall be responsible for coordinating the final location of fixtures and fixture supports with other work, such as duct work, building steel, overhead cranes and hoists, and mechanical piping and equipment.

** End of Section **

SECTION 31 00 00

EARTHWORK

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Earthwork includes clearing, excavation, filling and grading.
- B. The extent of clearing, excavation, filling and grading is shown on the drawing.
 - 1. Remove shrubs, trees, grass or obstructions which interfere with new construction and are not noted to be removed by Owner. Preparation of subgrade for slabs and pavements is also included as part of this work.
 - 2. The owner shall reuse or store suitable removed items at their discretion. Contractor shall transport removed items to Owner approved location.
 - 3. Replant existing shrubs per owners approved location.

1.2 QUALITY ASSURANCE

Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.3 FIELD QUALITY CONTROL

Quality Control Testing will be required during construction.

- A. Testing agency will inspect and owner will approve subgrades and fill layers before further construction work is performed thereon.
- B. If, based on reports of Testing Agency and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

1.4 JOB CONDITIONS

- A. Existing Utilities: Locate existing underground utilities in the areas of work.
 - 1. Should uncharged or incorrectly charged piping or other utilities be encountered during excavation, consult the Owner immediately for directions as to proceed.
 - 2. Contact "Miss Utility" (1-800-441-8355) and Owner for assistance in locating existing utilities.
- B. Protection of Persons and Property:
 - 1. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.5 RELATED WORK SPECIFIED ELSEWHERE

Erosion and Sediment Control: Section 31 25 00

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

- A. Subgrade Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand, as acceptable to the Owner.
- B. Backfill and Fill Materials: Provide acceptable soil materials for backfill and fill from borrow, or on-site stockpile, free of clay, rock, or gravel larger than 1" in any dimension, debris, waste, frozen materials, organic and other deleterious matter.

PART 3 – EXECUTION

3.1 INSPECTION

Examine the areas and conditions under which excavating, filling and grading are to be performed and determine suitability of stockpiled soil for use as backfill and fill material. Do not proceed with the work until satisfactory conditions have been corrected in an acceptable manner.

3.2 EXCAVATION

- A. Excavation consists of removal and disposal of material encountered when establishing required grade elevations.
- B. Earth excavation consists of removal and disposal of pavements and other obstructions visible on ground surface.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner.
- D. Underfootings, foundation bases or slabs fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, only when acceptable to the Owner.
- E. Elsewhere, backfill and compact unauthorized excavation as specified for authorized excavations of same classification, unless otherwise directed by the Owner.
- F. Stability of Excavations
 1. Slope side of excavation to comply with local codes and ordinances having

- jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- G. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and crossbraces, in good serviceable condition.
1. Provide minimum requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- H. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 2. Convey water removed from excavations and rainwater to collecting or run-off areas. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Comply with applicable sediment control measures. Do not use trench excavations as temporary drainage ditches.
- I. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess and/or unsatisfactory soil material and waste materials as specified hereinafter.
- J. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10" and extending a sufficient distance from footings and foundations to permit placing and removal of concrete form work, installation of services, other construction required, and for inspection. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
- K. Excavation for Pavements: Cut surface under pavements to comply with cross sections, elevations and grades as shown.
- L. Removal of Unsatisfactory Soil Materials: Excavate unsatisfactory soil materials encountered that extend below required elevations, to additional depth directed by the Engineer. Unsatisfactory material is defined as clay, wet soil, silt, etc. which would not, in the Engineer's opinion, provide adequate strength and would not compact properly. Unsatisfactory material shall be removed from the site.

3.3 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification.
- B. Percentage of Maximum Density Requirements: Provide not less than following percentages of maximum density of soil material compacted at optimum moisture content, as measured by AASHTO T-180, Method C, for the actual density of each layer of soil material-in-place.
 - 1. Building Slabs and Steps: Compact top 12" of subgrade and each layer of backfill or fill material at 95% maximum density.
 - 2. Lawn or Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density.
 - 3. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 95% maximum density.
 - 4. Pavements: Compact top 12" of subgrade and each layer of backfill or fill material at 95% maximum density.
- C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material.

3.4 BACKFILL AND FILL

- A. General: Place satisfactory excavated, borrow or stockpiled material in layers to required subgrade elevations, in excavations under grass areas, under walks and pavements and under steps.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance by Architect of construction below finish grade including, where applicable, damp proofing, and perimeter insulation.
 - 2. Inspection, testing, approval, and recording locations of underground utilities.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 - 5. Removal of trash and debris.
- C. Ground Surface Preparation:
 - 1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
 - 2. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.
- D. Placement and Compaction:

1. Place backfill and fill materials in layers not more than 8" in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.

3.5 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
 1. Grassed Areas: Finish areas to receive topsoil to within not more than 0.10' above or below the required subgrade elevations.
 2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below the required subgrade elevations.
 3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 0.10' above or below the required subgrade elevation.
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 0.2'.
- D. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.6 MAINTENANCE

- A. Protection of Graded Areas:
 1. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
 2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

END OF SECTION

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 – GENERAL

1.1 DESCRIPTION

Work specified under this section includes, but is not limited to clearing, grubbing, and removal of shrubs, trees, grass, or obstructions which interfere with new construction and are noted to be removed per drawings.

1.2 USE OF EXPLOSIVES

The use of explosives will not be permitted.

1.3 PROTECTION OF PERSONS AND PROPERTY

Clearing and grubbing operations shall be conducted in a manner that will ensure safety of persons and prevent damage to existing structures and utilities, construction in progress, trees, vegetation designated to remain standing including root damage, and other property.

PART 2 - PRODUCTS

2.1 FILL MATERIAL FOR DEPRESSIONS CREATED BY CLEARING AND GRUBBING

Fill material needed for filling depressions shall be completely filled with approved fill material within base prices bid, unless further excavation or earthwork is indicated.

Fill material needed for filling depressions shall be MDOT Department of Transportation borrow material, in accordance with other Section or approved excavated material.

Where topsoil is removed coincident with removal of roots and stumps or other activities, and plantings comprise the finished surface restoration, depressions shall be filled with imported topsoil obtained at Contractor's expense.

PART 3 - EXECUTION

3.1 CLEARING OPERATIONS

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring within the areas to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be completely removed except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within or adjacent to the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and of live branches to the indicated height. Limbs and branches to be trimmed shall be neatly cut close to main branches. Cuts more than 2 inches in diameter thus made shall be painted with tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or

by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.2 GRUBBING OPERATIONS

The Contractor shall completely remove stumps, roots including matted roots, and organic or other debris protruding through the ground surface. This material shall be excavated and removed to a depth of not less than 12 inches below the surface level of the original ground. Mechanical grubbing equipment shall not be used inside the drip line of trees indicated to remain standing.

3.3 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed. Arrange to shut off indicated utilities with utility companies. Call "Miss Utility of Delmarva" and the Town for assistance in locating existing utilities. If utilities are to remain in place, provide adequate means of protection during construction.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during work, consult Owner of utility and ENGINEER immediately for directions as to procedure. Repair damaged utilities that are to remain in service to the requirements of the utility Owner.

3.4 TOPSOIL STRIPPING

- A. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- B. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Do not stockpile topsoil within drip line of remaining trees.
 - 2. Dispose of excess topsoil as specified for waste material disposal or salvage to OWNER at OWNER's option.

3.5 FILLING DEPRESSIONS

- A. Depressions resulting from grubbing operations shall be completely filled with approved fill material, unless further excavation or earthwork is indicated.
- B. Prior to filling, subgrade surfaces of depressions shall be free of standing water, frost, or frozen material.
- C. For structural embankment the Contractor shall place fill material in horizontal layers not to exceed 8 inches in loose depth. Each layer shall be compacted to ± 2 percent of the optimum moisture content and to 90% of maximum dry density in areas outside of paving or structural support and 95% in areas of proposed paving or structural support, as determined by ASTM D1557. The density of soil-in-place shall be determined in accordance with ASTM D1556, Sand Cone Method or ASTM D2922, Nuclear Method. The surface of filled depressions shall be graded to meet adjacent proposed contours and to provide surface water drainage.

- D. For topsoil areas, mound up higher than finished grade so that grades following settlement are proper. Refill irregularly settled areas so as to provide positive drainage.

3.6 PROTECTION OF TREES

- A. Trees left standing shall be protected against damage, including that due to unnecessary cutting, breaking or skinning of the roots, skinning and bruising of the bark, and smothering of trees by stockpiling construction materials or excavated materials within drip line. The Contractor shall provide temporary earth-retaining structures, fences, barricades, and guards as required for the protection of trees to be left standing, as shown on the drawings.
- B. Tree roots over 1-1/2 inches in diameter requiring cutting shall be coated on cut faces with an emulsified asphalt or other approved coating especially formulated for horticultural use on cut or damaged plant tissues. Exposed roots shall be temporarily covered with wet burlap to prevent roots from drying out and earth cover shall be provided as soon as possible.
- C. Trees to be left standing that are damaged by construction operations shall be repaired or replaced at no additional cost to the OWNER. Tree repair shall be performed by a qualified tree surgeon.

3.7 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

- A. Burning of materials on site will not be permitted.
- B. Felled timber larger than 6 inches in diameter and considered sellable shall become the property of the Contractor and shall be immediately removed from the PROJECT site.
- C. Other felled trees, logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations shall be removed for disposal within the PROJECT bid amount at no additional cost to the OWNER. Costs of permits and fees for disposal shall be paid by the Contractor.

3.8 MAINTENANCE OF CLEARED AREAS

Contractor shall maintain cleared areas throughout the PROJECT until final acceptance by removing any fallen or in-danger-of-falling trees.

END OF SECTION

SECTION 31 23 00

EXCAVATION & FILL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included in this section shall include furnishing all labor, materials, and equipment necessary for the Contractor to perform all excavation, backfilling, filling, grubbing and grading required for construction and installation of pipelines, pavements, sidewalks, landscaping, structures and appurtenances and to perform general site grading. Excavation shall include removal of pavement, concrete, rock, earth and debris, regardless of character. Trenches and excavations shall be sheeted, shored and braced by the Contractor, as necessary to allow construction and to protect surface paving and adjacent structures, and provide safe working conditions. Additionally, the Contractor shall be responsible for maintaining a dry excavation by dewatering. They shall also locate, support and protect existing utilities and structures encountered in the work, provide traffic control where required, dispose of surplus and unsuitable excavated materials and restore backfilled areas to original condition or as required by the drawings and specifications. All backfilled and restored areas shall be maintained by the Contractor, in a proper condition, for the duration of the PROJECT.
- B. The Contractor is responsible for direct or indirect damage to existing structures, pipelines, conduits, utility poles, wires and utilities of every description in the vicinity of their work whether above or below ground, or that may be encountered in trench or structure excavation, whether or not such utilities are shown on the Drawings. This responsibility shall include the cost of protection by sheeting, bracing, hand excavation, when warranted, and the expense to repair or replace any existing facility damaged directly or indirectly by construction activities under this contract.
- C. The Contractor shall verify the location, size and elevation of all existing utilities at the various points of connection and/or crossings prior to starting any work. Any discrepancies in locations or elevations shall be brought immediately to the attention of the ENGINEER in order that the designs may be adjusted accordingly. Damages suffered or additional costs incurred by the Contractor as a result of their failure to conform to the requirements of this paragraph shall be the sole responsibility of the Contractor. Connections to existing utilities shall be made by the Contractor at such a time and in such a manner as the ENGINEER may direct, and the cost shall be included in the price bid for pipeline and structures, unless otherwise defined elsewhere in the proposal.
- D. Excavation and backfill within an area where a State agency has jurisdiction shall be done in accordance with requirements and provisions of the permits issued by the agency for construction within their respective right-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications.
- E. Prior to excavation, the Contractor is to obtain soil explorations in the areas of the proposed PROJECT which are to be carried out by a qualified geotechnical engineer to determine subsurface conditions.

1.2 SUBMITTALS

- A. Submit for approval certified gradations, plasticity index and soil classification of each type of material proposed for use.
- B. Submit copies of all laboratory and field soil test results directly to the ENGINEER within twenty-four (24) hours of completion of test.

1.3 QUALITY ASSURANCE

- A. Compaction:
 - 1. Top twelve (12") of subgrade and each eight (8") loose layer of backfill and fill under structures and utilities. Building slabs, steps, sidewalks, utilities, pavement and structure base slabs shall be compacted to ninety-five (95) percent maximum density, ASTM D 1557, unless otherwise noted.
 - 2. Top six (6") of subgrade and each layer of backfill under lawns or unpaved areas, shall be compacted to ninety (90) percent maximum density, ASTM D 1557.
- B. Grading Tolerances Outside Building Lines:
 - 1. Lawns, unpaved areas, walks, and embankments, plus or minus one (1") inch.
 - 2. Stone and asphalt pavements, plus or minus half (1/2) inch.
- C. Grading Tolerance for Fill Under Building Slabs: Plus or minus ½ inch measured with a 10' straightedge.

1.4 PROJECT CONDITIONS

- A. Contact the OWNER and Miss Utility at 1-800-441-8355 at least forty-eight (48) hours prior to beginning installations.
- B. Existing Utilities: Do not interrupt existing utilities, electrical, yard piping, etc. serving facilities occupied by the OWNER or others except when permitted in writing by the ENGINEER and then only after acceptable temporary utility services have been provided. Provide a minimum forty-eight (48) hours' notice to the ENGINEER and receive written notice to proceed before interrupting the utility.
- C. All soil testing services shall be performed by an independent testing agency coordinated by the Contractor and the R.P.R.

PART 2 - PRODUCTS

2.1 GENERAL

- A. No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise

removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

- B. Materials used for backfill and fill shall be free of clay clods, rock or gravel larger than two (2") inches in any dimension and debris, waste, frozen materials, and other deleterious matter.

2.2 SOIL MATERIALS

- A. General: Provide approved satisfactory borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Materials shall comply with Maryland Department of Transportation State Highway Administration Standard Specifications.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SC, and SM; free of rock or gravel larger than two (2) inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Satisfactory soil materials shall conform to Maryland State Highway Administration Section 916.01 - Select Borrow.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials unless otherwise approved by the ENGINEER.
- E. Pavement Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, conforming to Maryland State Highway Administration Section 901 for Graded Aggregate Base.
- F. Structural Fill: ASTM D 2487 Soil Classification Groups SM and/or SC.
- G. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D448, coarse aggregate grading size 57 conforming to AASHTO M43 type No. 57.
- H. Pipe Bedding Material: Artificial foundation using drainage fill, as noted above.
- I. No soil material shall be considered unsatisfactory due to moisture content. Contractor shall dry soils with excess moisture or add additional moisture to any material at no additional cost to the OWNER.

2.3 SUITABLE BACKFILL

All suitable materials removed from the excavation shall be used for backfill and/or subgrade replacements of unsuitable materials. No excavated material shall be wasted without permission of the ENGINEER. As material is excavated it shall be separated into suitable and unsuitable material stockpiles for reuse or disposal as the case may be. No payment for select backfill under contingencies will be approved until all suitable soils from excavations have been expended.

2.4 SELECT BACKFILL

- A. Should the Contractor encounter unsuitable material during excavation, they shall remove and dispose of such material at a location approved by the ENGINEER. The cost of such disposal shall be included in the appropriate prices bid.
- B. Should sufficient suitable material from excavations on the PROJECT not be available for backfill, the Contractor shall furnish Select Backfill upon approval of the ENGINEER. Special backfill shall conform to the requirements for satisfactory soil materials per Section 2.2. Contractor shall pay for all testing necessary for approval of the select materials including sampling, sieve analysis, Atterberg limits and classification.
- C. The Contractor shall furnish certification that their borrow is from a Maryland State Highway Administration approved source.
- D. Contractor shall dry soils with excess moisture or add additional moisture to any material at no additional cost to the OWNER.
- E. Payment for removal of unsuitable subgrade material and replacement with select backfill as authorized by the ENGINEER will be made at the unit price bid for the material placed within the payment trench width detailed on the PROJECT plans and for the length and depth approved. For backfill around structures, select backfill payment volume will be limited to an area 3'0" outside the foremost edge of the structure on all sides and from the bottom of the structure to the ground surface. This item is for unsuitable subgrade and backfill material only and does not apply to embankment or fill material required for PROJECT construction which is to be included in the lump sum price.

2.5 ARTIFICIAL FOUNDATION

Artificial Foundation and pipe bedding material shall consist of course aggregate crushed gravel with angular edges grading size 57 conforming to Maryland State Highway Administration Aggregates Specification Section 901.01.

2.6 TOPSOIL

Topsoil shall mean friable clay loam surface soil suitable for use in grass planting. It occurs as a thin soil layer covering naturally well-drained land covered by a heavy growth of grass or which has been covered with a heavy growth of grass during the latest growing period before start of construction. In addition, the topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps, and other objects larger than two (2") inches in any dimension, roots, and other objectionable material.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with individual specifications, the contract drawings, and regulations/recommendations of State and local agencies having jurisdiction.

3.2 STRIPPING

- A. Remove all organic material from the roadways and building construction areas. Stockpile all suitable material for reuse as topsoil during final grading and stabilization process. Remove all unsuitable materials from the site at the end of the PROJECT.
- B. The depth of stripping shall be a minimum of six (6") inches or as required by actual field conditions.

3.3 GENERAL EXCAVATION

- A. Explosives: The use of explosives shall not be permitted on this PROJECT.
- B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.
- C. Excavated materials shall be segregated as they are excavated, with the suitable and unsuitable materials and topsoil being piled separately according to designated use specified in Part 2 of this section. All suitable materials shall be used for backfill or embankment. Suitable wet materials shall be dried to optimum moisture content at the Contractor's expense and be used for backfill or embankment. All unsuitable materials shall be removed, at the Contractor's expense and disposed of after the PROJECT is completed at a location approved by the ENGINEER. No excavated material shall be deposited at any time so as to endanger partly finished structures either by direct pressure, or indirectly by overloading banks contiguous to the operation.
- D. The Contractor shall employ the services of a soil testing agency acceptable to the ENGINEER to determine adequacy of excavated material for reuse as backfill or embankment. Submit results of testing to ENGINEER for approval.
- E. Excavation may be moved directly to areas of fill and embankment. However, the Contractor must schedule the work so that all construction areas will remain free draining, without any ponding of water. Temporary ditches and dewatering operations shall be constructed, if necessary, to accomplish this end. If, at the time of excavation, it is not possible to place material in its proper location as fill or embankment, it shall be stockpiled for later use and shall be stabilized in an approved manner if not to be utilized within fourteen (14) calendar days.

3.4 PIPELINE TRENCH EXCAVATION

- A. The Contractor shall excavate, maintain and backfill all excavation necessary for completing the work under the contract. Unless otherwise specified or approved, excavation shall be open cut. No extra compensation will be allowed for hand excavation and backfill necessary to complete the work as required by the ENGINEER.
- B. Trenches shall be excavated to the necessary width and depth, as shown on the drawings

and as required for the placement and removal of protective sheeting, pull boxes, etc. No extra compensation will be allowed for trenches wider than that detailed on the drawings.

- C. The sides of the trenches shall be practically plumb and shall not be sloped unless approved in writing by the ENGINEER. Trench sides shall be supported or sheeted as required to protect the public, construction personnel, pavement surfaces, curbing, utilities, structures, etc., and required for safety. Safety regulations shall be as required by State safety codes and OSHA. Refer to Part 3.8 of this section for sheeting requirements.
- D. In paved areas, the Contractor shall remove the paving only as necessary for the excavation of the trench or as detailed. Pavement edges at the trench shall be saw cut neat, straight, and to the full depth of paving prior to the start of any excavation. Should the Contractor disturb or damage pavement to a greater width than detailed on the drawings or should pavement damage result from cave-ins, settlement, etc., the Contractor shall replace such paving at their own expense.
- E. In non-paved areas, strip surface vegetation and suitable topsoil and place in stock piles which are separated from the trench excavated materials. Topsoil shall not be used for general trench refill.
- F. The excavation of all trenches shall be fully completed at least twenty (20) feet in advance of pipe laying, unless otherwise authorized or directed. The ENGINEER may require the backfilling of open trench, over completed pipelines, or ahead of the pipe laying operation, if in their judgment such action is necessary, and the Contractor shall have no claim for extra compensation.
- G. Should work be stopped for any reason and any excavation is left open for an unreasonable length of time, the Contractor shall refill the excavation at their own expense if so directed by the ENGINEER, the Inspector or OWNER. They shall not reopen the excavation until they are ready to complete the facility. Should the Contractor refuse or fail to refill any excavation completely within forty-eight (48) hours, or immediately if it poses a safety hazard, after a proper notice has been given by the ENGINEER, Inspector, or OWNER, the OWNER shall be authorized to do the work. The resulting expenses shall be deducted from monies due the Contractor.
- H. The Contractor shall complete excavation as nearly as practicable to the lines of the pipeline to be installed as detailed. All cavities in the bottom of the trench shall be filled to the required level with compacted crushed stone or gravel. Unless the cavities have been made on direction of the ENGINEER and classified as "Excavation Below Subgrade" for unsuitable material, no extra compensation shall be due the Contractor.
- I. Excavated materials shall be graded, hauled, stored and protected as such material found suitable will be required for backfilling, or other purposes. Material classified as unsuitable shall be disposed of by the Contractor at a location approved by the ENGINEER. Hauling of excavated materials for any purpose shall not entitle the Contractor to additional compensation. Only those excavated materials designated by the OWNER shall become property of the Contractor.
- J. All stockpiled materials shall be placed in such a way to prevent damage to the trench, structures, drainage areas or private property. Excavated materials shall not be placed on private property, unless written permission is obtained from the property owner by the

Contractor.

- K. The Contractor shall remove, relocate or protect all structures including but not limited to signs, mailboxes, overhead and buried utilities and other structures in the path of work as required for construction whether shown on drawings or not. No extra compensation will be allowed for property damage, injury or loss of time due to obstructions encountered that are not shown on the plans.
- L. The Contractor shall be responsible for any damage to utilities, curb, gutter, sidewalk, traffic control devices, pavement material, pavement markings and lawns. Any damage resulting directly or indirectly during construction shall be replaced in kind by the Contractor without additional compensation. The reuse of disturbed curb, gutter or sidewalk is prohibited. New sections shall be installed to the nearest undisturbed joint. Cost for replacement shall be included in the appropriate price bid.

3.5 PIPELINE TRENCH BACKFILL

- A. Materials excavated from the trench except topsoil shall be used for trench backfill, provided that, in the opinion of the ENGINEER, the excavated material is suitable for this purpose. Backfill material shall be free from large lumps, pavement, pieces of concrete and stones.
- B. Suitable material, as approved by the ENGINEER, shall be carefully deposited in the trench by methods which will not damage or disturb the pipeline or structure, and shall be solidly tamped around the pipe or structure. Backfill material shall be placed in six (6") inch loose layers and hand tamped until the top of pipe is covered by at least twelve (12") inches of compacted material. Above this point, backfill material shall be placed in eight (8") inch loose layers. Compaction for eight (8") inch layers shall be accomplished by mechanical tampers or other approved methods. Care shall be taken in the use of mechanical tampers not to injure or move the pipe or to cause the pipe to be supported unevenly. Each layer shall be mechanically tamped for the full trench width unless an alternative method is approved in writing by the ENGINEER.
- C. Every backfill layer shall be compacted as per Section 1.3.A. Materials containing an excess of moisture shall be permitted to dry until the moisture content is within the specified range. Materials too dry shall be wetted uniformly, at the Contractor's expense, until the moisture content is in the specified range.
- D. No compacting shall be done when the material is too wet to be compacted properly. At such times, the work shall be suspended until the backfill materials have dried sufficiently to permit proper compaction or such other precautions shall be taken as may be necessary to obtain proper compaction. The Contractor is responsible for hauling, storing and drying of excavated material to be used in backfill operations within the prices bid.
- E. The ENGINEER may request compaction tests of the backfilled trenches at any time during construction or upon completion of the backfill operations. Such testing shall be arranged by the Contractor and performed by an independent testing agency approved by the ENGINEER. The Contractor shall pay the testing laboratory for all tests performed inclusive of sample collection, preparation and transportation. If the results of any tests shown that backfills do not meet the specified compaction, the Contractor shall, at their own expense, correct the condition as directed by the ENGINEER.

- F. The Contractor shall, at their own expense, maintain all refilled excavations in proper condition. Trench surfaces shall be reshaped when necessary. If the Contractor fails to make repairs within forty-eight (48) hours after receipt of written notice from the OWNER, the OWNER may refill said depression wherever necessary and the cost of so doing will be retained from any monies due or to become due the Contractor under the Contract. The Contractor shall be fully responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time prior to final acceptance.
- G. All unauthorized excavations made by the Contractor shall be immediately backfilled in accordance with the requirements of the specifications for trench backfill at the Contractor's expense.
- H. After completion of backfilling, all material not used shall be disposed of as approved by the ENGINEER, and all places on the line of the work shall be left clean and in good condition. This cleaning up shall be done by the Contractor without extra compensation. If they fail to do this work within a reasonable time after receipt of notice, it will be performed by the OWNER, and the cost will be retained from the monies due the Contractor under the Contract.
- I. No backfilling of pipelines will be allowed until measurements of pipe and an inspection has been performed by the OWNER's representative, and until the ENGINEER has authorized the backfill. Any unauthorized backfill of pipelines shall be uncovered by the Contractor at their expense if required by the ENGINEER.
- J. The Contractor shall exercise caution in backfill and compaction to prevent damage to structures.
- K. Backfill trenches with concrete that carry below or pass under footings and that are excavated within eighteen (18") inches of footings. Place concrete to the level of the bottom of footings.

3.6 EXCAVATION BELOW SUBGRADE AND GRAVEL REFILL

- A. Materials below the excavation limit for pipelines and structures (below subgrade), which in the judgment of the ENGINEER should be removed, shall be removed as directed. All spaces created by the removal of unsuitable material below subgrade shall be refilled and compacted with crushed stone or gravel, specified in "Artificial Foundation" of this section. The top, sides and bottom of the excavation shall be wrapped with a non-woven filter fabric as recommended by the geotechnical engineer performing testing for the Project. Payment for Excavation Below Subgrade and Gravel Refill shall be made at the unit price bid only for the length width and depth authorized.
- B. Should the Contractor elect to excavate suitable material below subgrade and install stone for the purpose of securing a dry trench bottom, in lieu of dewatering by mechanical methods, no payment will be made for Excavation Below Subgrade and Gravel Refill.

3.7 DEWATERING

- A. Surface water and subsurface ground water shall be prevented from entering excavations, from ponding on prepared subgrades, and from flooding PROJECT site and surrounding area.

- B. Subgrades and foundation soils shall be protected from softening and damage by rain or water accumulation.
- C. All excavations must be kept free of water below the subgrade of the work while work is in progress. This may be accomplished by ordinary pumping methods or by well points, whichever will produce the required results. The Contractor shall obtain all necessary dewatering permits at no additional expense. Upon removal of dewatering equipment, the Contractor shall backfill all holes and restore disturbed areas to their original condition.
- D. Dewatering for the structures and pipelines shall commence when groundwater is first encountered and shall be continued until such time as backfill has been completed. No concrete or pipe shall be laid in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Groundwater shall not be allowed to rise around the pipe until the trench is backfilled.
- E. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction without prior consent of the ENGINEER. Water shall be disposed of in such a manner as not to be a menace to the Public Health.
- F. In the event the Contractor's dewatering operations affect any water supplies within the PROJECT area, the Contractor shall take whatever steps required in providing uninterrupted water service.
- G. The Contractor shall remove any siltation deposits in storm sewer systems, resulting from their dewatering or construction operations.
- H. Contractor shall be responsible for conveyance of dewatering flows and for erosion and sediment control in conformance with local and state requirements.
- I. The cost associated with dewatering operations shall be included in the appropriate price bid. No extra compensation will be allowed.
- J. Contractor shall be responsible for obtaining well permits for dewatering and shall meet all applicable requirements. Contractor shall also obtain all necessary discharge permits as required for dewatering and for erosion and sediment control and shall comply with the requirements of all agencies having jurisdiction thereof.

3.8 SHEETING, SHORING AND BRACING

- A. The Contractor shall furnish and install all sheeting, shoring and bracing and other protective systems necessary to ensure safe working conditions, to prevent subsidence of earth and caving embankments, and to prevent injury and death as well as damage to public and private property and structures. The Contractor is responsible for obtaining proper design of such protective systems. The Contractor shall employ an on-site "Competent Person" as defined by OSHA 1926.650 (b), who is responsible for, but not limited to: the locations and protection of underground installations; recognize and control hazards due to water accumulation; daily inspections of excavations, adjacent areas and protective systems; determine the impact of distress and/or surcharge loads and adjust the protective systems accordingly.

- B. Sheeting, shoring and bracing and other protective systems shall be removed as backfilling progresses, except at such locations as the ENGINEER may direct or approve it to be left in place.
- C. The conditions of all excavations made by the Contractor shall be the responsibility of the Contractor. No extra compensation will be allowed for property damage, injury or loss of time, due to excavation slides or cave-ins at any time under any circumstances.
- D. The Contractor shall cut off any sheeting left in place, at least eighteen (18") inches below finished grade and shall remove the material cut off without compensation.
- E. Where necessary, in quicksand, soft ground, or for the protection of any structure or property, sheeting shall be driven to such depth below the bottom of the trench as may be required to protect all existing and/or proposed work.
- F. The cost for furnishing, placing and removal of sheeting, shoring or bracing shall be included in the prices bid.
- G. A trench box is an acceptable alternative for pipeline installation to sheeting, shoring or bracing providing such boxes conform to safety codes and work is monitored by the Contractor's "Competent Person".

3.9 SUITABLE BACKFILL

All suitable materials removed from the excavation shall be used for backfill and/or subgrade replacements of unsuitable materials. No excavated material shall be wasted without permission of the ENGINEER. As material is excavated it shall be separated into suitable and unsuitable material stockpiles for reuse or disposal as the case may be. No payment for select backfill under contingencies will be approved until all suitable soils from excavations have been expended.

3.10 APPROVAL OF SUBGRADE

- A. Notify ENGINEER when excavations have reached required subgrade.
- B. Proof roll subgrade areas to receive bituminous paving with a fully loaded tandem axel dump truck or equal load as approved by the testing agency in the presence of the ENGINEER or their representative prior to compaction. The contractor shall remove all subgrade soils where pumping occurs.
- C. When ENGINEER determines that unforeseen unsatisfactory soil or soft areas are present, continue excavation and replace with compacted backfill or fill material as directed. Provide penetrometer testing for structural subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the ENGINEER at no additional cost.

3.11 VERIFICATION OF SOIL BEARING CAPACITY

The Contractor shall be responsible for testing of the available soil bearing capacity below the foundation of any structure. They shall arrange for such testing by an independent agency approved

by the ENGINEER. The Contractor shall pay the agency for at least two (2) three (3)-foot deep penetrometer tests and subsequent bearing capacity evaluation as specified on the drawings per 1000 S.F. area, minimum one (1) per individual structure or basin. If the required value as stated in the structural notes is not reached, the Contractor shall compact the subgrade by means of vibratory rollers and pay and arrange for retesting until the required values are met.

3.12 UNAUTHORIZED EXCAVATION

Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the ENGINEER. Fill unauthorized excavations under other construction as directed by the ENGINEER.

3.13 FILL AND EMBANKMENT

A. Contractor shall furnish and place, within the prices bid and at no additional cost to the OWNER, all structural fill to meet the construction requirements of the Contract Documents. Only material meeting the specifications will be approved for use. Contractor shall dispose of excess material off site within prices bid.

B. Structural Fill and Embankment

1. Structural Fill and Embankment for roadways, embankment, and structures shall be constructed of friable, compatible material from excavation or borrow. The material shall be free from debris, organic matter or excessive amounts of clay. Soils shall be classified as SM and/or SC (Unified Soils Classification).
2. Structural fills shall be constructed in loose layers not exceeding eight (8") inches loose thickness for the full width of the cross section. Construction shall proceed in such manner as to keep all areas free-draining, without ponding of water. Construction shall be suspended when satisfactory results cannot be achieved on account of wet or freezing weather.
3. Each layer of fill or embankment shall be compacted to not less than ninety-five (95) percent of maximum density as determined by ASTM D 698, by means of multiple-wheel pneumatic tired rollers, vibratory rollers, or other approved types, unless otherwise noted.
4. Compacting shall be continued until the required compaction has been achieved. Displacement of soil under or ahead of the roller shall be sufficient evidence that required compaction has not been achieved.
5. Fills and embankments shall be carried to the finished grades shown, less the necessary allowance for pavement, topsoiling, etc. Fine grade all areas prior to construction of finishing courses.
6. Frozen materials shall not be placed in fills and embankments. Any materials which freeze after being placed shall not be covered over until it has completely thawed.
7. Embankment and fill material which may be lost or displaced as a result of natural causes such as storms, cloudbursts, etc., shall be replaced by the Contractor with acceptable material at no additional cost to the OWNER.

3.14 EXCAVATION FOR STRUCTURES

- A. Excavate for structures, walls, foundations, footings, etc., to the depth and width required for construction and stripping of forms. Structural excavation shall consist of the excavation of all earth, rock, boulders, existing concrete and masonry foundations and walls, and all other materials encountered regardless of type, which the Contractor may encounter. No extra compensation will be allowed for excavation greater than 3'0" outside the most exterior point of the structure.
- B. The sides of the excavation shall be practically plumb and shall not be sloped unless approved in writing by the ENGINEER. Sides shall be supported or sheeted as required to protect pavement surfaces, curbing, utilities, structures, etc., and required for safety. Safety regulations shall be as required by State safety codes and OSHA. Refer to Sheeting, Shoring, and Bracing of this Section.
- C. In paved areas, the Contractor shall remove the paving only as necessary for the excavation of the structure or as detailed. Pavement edges at the structure shall be saw cut neat, straight, and to the full depth of paving prior to the start of any excavation. Should the Contractor disturb or damage pavement for a greater width than detailed on the drawings or should pavement damage result from cave-ins, settlement, etc., the Contractor shall replace such paving at their own expense.
- D. In non-paved areas, strip surface vegetation and suitable topsoil and place in stock piles which are separated from the trench excavated materials. Topsoil shall not be used for general trench refill.
- E. Should work be stopped for any reason and any excavation is left open for an unreasonable length of time, the Contractor shall refill the excavation at their own expense if so directed by the ENGINEER, the Inspector or the OWNER. They shall not reopen the excavation until they are ready to complete the facility. Should the Contractor refuse or fail to refill any excavation completely within forty-eight (48) hours, or immediately if it poses a safety hazard, after a proper notice has been given by the ENGINEER or Inspector, the OWNER shall be authorized to do the work. The resulting expenses shall be deducted from monies due the Contractor.
- F. The Contractor shall complete excavation as nearly as practicable to the depths of the structure to be installed as detailed. All cavities in the bottom of the excavation shall be filled to the required level with compacted crushed stone or gravel. Unless the cavities have been made on direction of the ENGINEER and classified as "Excavation Below Subgrade" for unsuitable material, no extra compensation shall be due the Contractor.
- G. Excavated materials shall be graded, hauled, stored and protected as such material found suitable will be required for backfilling, or other purposes. Material classified as unsuitable shall be disposed of by the Contractor at the end of the PROJECT at a location approved by the ENGINEER. Hauling of excavated materials for any purpose shall not entitle the Contractor to additional compensation. Only those excavated materials designated by the OWNER shall become property of the Contractor.
- H. All stockpiled materials shall be placed in such a way to prevent damage to the structures, drainage areas or private property. Excavated materials shall not be placed on private property, unless written permission is obtained from the property owner by the Contractor.
- I. The Contractor shall remove, relocate or protect all structures including but not limited to signs, mailboxes, overhead and buried utilities and other structure in the path of work as

required for construction whether shown on drawings or not. No extra compensation will be allowed for property damage, injury or loss of time due to obstructions encountered that are not shown on the plans.

- J. The Contractor shall be responsible for any damage to curb, gutter, sidewalk, traffic control devices, pavement material, pavement markings and lawns. Any damage resulting directly or indirectly during construction shall be replaced in kind by the Contractor without additional compensation. The reuse of disturbed curb, gutter or sidewalk is prohibited. New sections shall be installed to the nearest undisturbed joint. Cost for replacement shall be included in the appropriate price bid.

3.15 BACKFILL FOR STRUCTURES

- A. Backfill around structures with suitable material from the excavation to the original surface grades shown on the plans or defined by the ENGINEER. If additional material is needed to backfill around the structure, Special Off-Site Backfill approved by the ENGINEER shall be furnished and placed by the Contractor within the lump sum price bid.
- B. No backfill shall be placed against new concrete or masonry structures until properly cured.
- C. Backfill shall be placed in eight (8") inch loose layers and compacted by mechanical tampers or other approved methods. Compaction shall conform to the requirements for compaction already set forth in this specification.
- D. The Contractor shall exercise caution in backfill and compaction to prevent damage to structures.

3.16 TEMPORARY REPAVING

- A. The Contractor shall furnish, place and compact two (2") inches of cold patch as temporary pavement surface over all backfill areas created for pipeline and structure installation located in roadways or driveways. This surface shall be maintained by the Contractor until permanent surface restoration has been performed.
- B. Should the Contractor remove existing pavement beyond the width specified or detailed on the plans, or should pavement be disturbed from settlement, slides or other construction activities, they shall saw cut back the pavement and provide temporary paving in these areas.
- C. In all other areas over which the Maryland State Highway Administration exercises jurisdiction, all pavement restoration shall be done in accordance with the permit requirements of the agency.

3.17 GRADING

A. PREPARATION

- 1. Prepare subsoil surface for finish grading by dressing and shaping to provide for uniform placement of topsoil or other surface as specified.
- 2. Cut and fill to within 0.2 foot of the correct subgrade elevations. Set elevation to top of subgrade under paved areas to bottom of the pavement base. Set elevation of the top of subgrade under areas to receive topsoil, 4 inches below finished

- grades.
- 3. Furnish additional material required for rough grading, backfill or fill.
- 4. Remove surface rock or other foreign objects exceeding two (2") inches in greater dimension. Dispose of such rock and debris in a lawful manner off-site.
- 5. Provide smooth transition between existing adjacent grades and new grades.

B. PERFORMANCE

1. Placement of Topsoil: Place topsoil over areas indicated for new grading contours. However, before topsoil construction work in these areas shall have been completed. Observe precautions as follows:
 - a. Do not place topsoil over areas indicated to receive paving or sidewalk.
 - b. Do not work topsoil or liner material while frozen or wet. Do not work materials in a dusting condition, but moisten same to prevent a dust nuisance.
 - c. Scarify subsoil to a depth of two (2") inches for bonding topsoil with subsoil.
 - d. On sloped areas, work topsoil or liner material into subsoil to blend so as to eliminate any semblance of slip-planing between the two soils, but leave a sufficient cover of topsoil to insure seed germination. Perform such blending of soils by ridging or serrating the subsoil on the slopes.
 - e. Place topsoil as needed for dressing-up minor depressions due to settling and erosion and to eliminate any other minor irregularities.
2. Finished Elevations and Lines of Grassed Areas: Grade topsoiled areas of the site to within a tolerance of one (1) inch of the elevations and lines indicated and in accordance with the following.
 - a. Grade a uniform longitudinal fall in swales and other surface drainage areas to provide a drainage flow line that can easily be maintained and traversed with normal lawn maintenance equipment.
 - b. Establish finish grade of topsoil ½ to ¾ inches below top of abutting walks or paving to provide positive drainage of same
 - c. Place and grade topsoil to a depth not less than four (4") inches nor greater than twelve (12") inches.
 - d. Compaction: Compact finish grades as the final operation using a light roller weighing not over 120 pounds per foot-width of roller.
 - e. Tillage: Till finish graded soil over areas indicated for lawn regardless of type of lawn work performed. Use equipment and methods common to such work and till soil to a two inch depth minimum.
 - f. Seed and mulch in accordance with the Surface Restoration and Paving sections and the PROJECT plans and details.

3.18 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Compaction and Density testing shall be coordinated by the Contractor with the ENGINEER and performed by an independent testing agency approved by the ENGINEER. The Contractor shall pay the testing laboratory for all tests performed inclusive of sample collection, preparation and transportation. Whenever test results

indicate compaction densities less than specified, the Contractor shall, at their own expense, secure the specified compaction and subsequent retesting with methods approved by the ENGINEER. The testing agency, employed by the Contractor, shall submit a copy of all testing reports directly to the ENGINEER. Each report shall contain the PROJECT identification name and number, name of Contractor, name of testing agency, and location of sample tested by station, location and depth as minimum. All test locations shall be as approved or required by the ENGINEER.

- B. Perform in-place density tests according to ASTM D 1556 (sand cone method) ASTM D 2167 (rubber balloon method) or ASTM D 2937 (drive cylinder method), as applicable. A copy of each test shall be forwarded to the ENGINEER within seventy-two (72) hours of testing.
 - 1. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
- C. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the ENGINEER.
- D. Footing Subgrade: At footing subgrades, perform at least one (1) test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the ENGINEER.
- E. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one (1) field in-place density test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three (3) tests.
- F. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
- G. Trench Backfill: In each compacted initial and final backfill layer, perform at least one (1) field in-place density test for each 200 feet or less of trench, but no fewer than two (2) tests.
- H. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.
- I. Contractor shall excavate previously backfilled areas upon request for field in-place density tests below the surface as directed by the ENGINEER.

3.19 MISCELLANEOUS EXCAVATION AND BACKFILL

- A. The Contractor shall do such miscellaneous excavation as may be necessary or directed. Such excavation shall be subject to the same conditions and requirements as specified for trench excavation.

- B. Miscellaneous Excavation shall include the digging of test pits, extra width of trench beyond the specified trench payment width made necessary by change in its alignment, or excavation for any special structures outside the trench that may not be shown on the drawings or described in the specifications, where such excavation is done at the direction of the ENGINEER.
- C. Test pits shall be dug by the Contractor whenever directed to determine location, depth or materials of existing utilities. The depth and size of test pits shall be such as required by the ENGINEER.
- D. Test pits shall also be dug by the Contractor, as authorized by the ENGINEER, along the lines of the trenches as shown on the drawings in advance of the excavation, or prior to use of mechanical moles, for the purpose of satisfying themselves as to the location and elevation of underground obstructions or conditions where such test pits are due within the limit of the trench excavation, no additional compensation shall be made. Test pits dug beyond the specified limits of excavation shall be paid under this bid item.
- E. Test pits dug which are noted on the PROJECT plans or in advance of pipe laying operations to verify utility locations or additional excavation required to use sheeting or trench boxes shall be included in the prices bid in the proposal. Additional test pits required shall be paid under the contingency bid item for such excavation; the Contractor shall be responsible for ensuring the Inspector or OWNER's representative is present to perform measurement of sub-excavation in order for the Contractor to qualify for such payment.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep newly graded areas free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the ENGINEER; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the PROJECT correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work and eliminate evidence of restoration to the greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

Disposal: Remove surplus soil and waste material, including unsatisfactory soil or excess satisfactory material, trash, and debris, and legally dispose of it off the OWNER's property.

3.22 INSTALLATION OF DETECTABLE WARNING TAPE

Pipeline detectable warning tape shall be installed continuously above all underground utilities including water mains and service lines, or other utility which may be installed or distributed as part of this PROJECT. Detectable tape of the color and label required by the particular utility shall

be installed in two (2) places, twelve (12") inches above the pipe and twelve (12") inches below the ground surface or as recommended by the tape manufacturer. Detectable tape shall be a minimum of two (2") inches wide and be imprinted with the words "Warning! Underground (Utility Type) Below" continuously along the tape. Provide tape colors to utilities as follows:

- A. Red: Electric power lines, cables, conduit and lighting cables
- B. Yellow: Gas, oil, steam, petroleum or gaseous materials
- C. Orange: Telephone, communications, alarm or signal lines, cables or conduit
- D. Blue: Potable Water systems
- E. Green: Sewer and stormwater systems

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 5. Remove dewatering system when no longer required for construction.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 - 1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 - 2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
- B. Delegated-Design Submittal: For dewatering system 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. Qualification Data: For qualified Installer.
- B. Field quality-control reports.
- C. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that specializes in dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 1. Notify Architect no fewer than three days in advance of proposed interruption of utility.
 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineers and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. The owner will not be responsible for interpretations or conclusions drawn from this data.
 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 2. The geotechnical report is included elsewhere in the Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damage to adjacent facilities caused by dewatering.
- F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 015000 "Temporary Facilities and Controls" or Section 311000 "Site Clearing" during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on a continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.
- G. Damages: Promptly repair damage to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells necessary; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 - 3. Fill observation wells when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

SECTION 31 25 00

EROSION & SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide necessary equipment, labor and supplies for erosion and sediment control throughout PROJECT. Work consists of grading of site, providing silt fence, and other necessary measures required for effective control. Sediment and erosion control work shall be as indicated on drawings and in compliance with applicable requirements of the governing authorities having jurisdiction. The receipt of a proposal by a bonafide BIDDER shall be interpreted to mean the Contractor has familiarized themselves with these Regulations and Rules of Procedure and is fully cognizant of exactly what is required.

1.2 SUBMITTALS

- A. Erosion and Sediment Control Schedule.
 - 1. At pre-construction conference or prior to start of actual construction, submit for acceptance, schedules for accomplishment of temporary and permanent erosion control work. Submit schedule for each of the following procedures: Clearing and grubbing, grading, facilities construction, paving, and surface restoration. No work shall be started until erosion control schedules and methods of operation have been approved.
 - 2. Schedule should be prepared on Contractor's letterhead. Send original and one (1) copy to OWNER.

1.3 EXECUTION

- A. Throughout the duration of the PROJECT, control erosion and minimize siltation to rivers, streams and impoundments. Control shall include, but is not limited to the use of berms, dikes, dams, sediment basins, sediment traps, filters, fiber mats, netting, gravel or crushed stone, mulch, grasses, slope drains, and other methods. Erosion and sediment control measures as described herein and on the drawings shall be applied to erodible materials exposed by any PROJECT activity.
- B. Coordinate erosion and sediment control measures with the construction of the permanent drainage facilities which shall be constructed prior to the grading operation to assure economical, effective and continuous erosion and siltation control.
- C. Dress, prepare, and seed slopes immediately following the completion of each portion of work and immediately following suspension of grading operations.
- D. Fill slopes shall be dressed, prepared and seeded as the embankment proceeds to the extent needed to stop erosion and sedimentation.

- E. The Contractor shall incorporate permanent erosion control features into the PROJECT at the earliest practicable time. Temporary erosion control measures shall be used to correct. Conditions that develop during construction that were not foreseen during the design stage, that are needed prior to installation of permanent erosion control features, or that are needed temporarily to control erosion that develops during normal construction practices that are not associated with permanent control features of the PROJECT.

END OF SECTION

SECTION 31 62 19

TIMBER PILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood piles.
2. Preservative treatment.
3. Pile tips.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Requirements for concrete, and placement of pile caps and grade beams.
2. Section 312316 - Excavation: Excavating to working level.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Designed Piles:

1. Design Pile Quantity: Determined by number of piles indicated in Contract Documents.
2. Design Pile Length: 40 feet
3. Test Piles: 5 feet longer than design length piles.

B. Actual Piles:

1. Actual Pile Quantity: Determined by number of piles identified in Project Record Documents.

1.3 REFERENCES

A. ASTM International:

1. ASTM D25 - Standard Specification for Round Timber Piles.
2. ASTM D245 - Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.
3. ASTM D1760 - Standard Specification for Pressure Treatment of Timber Products.

B. American Wood-Preservers' Association:

1. APWA U1 - Use Category System: User Specification for Treated Wood.
2. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.

C. Forest Stewardship Council:

1. FSC Guidelines - Forest Stewardship Council Guidelines.

1.4 PERFORMANCE REQUIREMENTS

- A. Drive piles to load supporting capacity of 20 tons.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate details and schedule of pile installation sequence. Identify recommended pile length and diameter to suit design requirements.
- C. Product Data: Submit details of tips.
- D. Certificate: Submit evidence of preservative treatment certification.
- E. Static Pile Test Reports: Submit within three days of completing each test.
- F. Pile-Driving Records: Submit within three days of driving each pile.
- G. Certified Piles Survey: Submit within seven days of pile driving completion.

1.6 PRECONSTRUCTION TESTING

- A. General: Static pile tests are used to verify driving criteria and pile lengths and to confirm allowable load of piles.
 1. Furnish test piles 60 inches (1524 mm) longer than production piles.
 2. Determination of actual length of piles is based on results of static pile tests.
- B. Pile Tests: Arrange and perform the following pile tests:
 1. Axial Compressive Static Load Test: ASTM D 1143/D 1143M. Procedure A, Quick Test.
 2. Axial Tension Static Load Test: ASTM D 3689.
 3. Lateral Load Test: ASTM D 3966.

1.7 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record the following:
 1. Sizes, lengths, and locations of piles.
 2. Sequence of driving.

3. Number of blows per foot (meter) for entire length of piles and measured set for last 10 blows.
4. Certificate of treatment from supplier.
5. Final tip and head elevations.
6. Driving force of each hammer blow.
7. Type and size of equipment.
8. Alignment deviations.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.
- B. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 5 years documented experience with sufficient production capacity so as not to cause a delay in work.
- B. Monitor pile driving operations by Geotechnical Engineer experienced in this Work and licensed in State of Maryland.

1.10 PROTECTION OF EXISTING UTILITIES & ADJACENT STRUCTURES

- A. Contractor to verify location of existing utilities and protect them and adjacent structures from damage caused by pile driving operations.
- B. Photograph and video tape adjacent structures and perform seismic monitoring during pile driving operations to ensure that seismic activity remains below acceptable limits.

1.11 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Piles: ASTM D25, southern pine Class B, clean peeled, friction type.
- B. Preservative Treatment: AWPAC U1.

1. Round Timber Piles: Commodity Specification E, Use Category 4C.

C. Dimensions:

1. Length: 40 foot.
2. Minimum Butt Diameter: 12 inches.
3. Minimum Tip Diameter: 7 inches.

- D. Pile Tip: Formed and welded steel with full contact with end of wood pile. To be used as required for hard driving conditions.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Grade piles in accordance with ASTM D245.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

- A. Obtain prior approval of hammer type to be used.
- B. Use driving method which will not cause damage to nearby structures.
- C. Notify adjacent and affected landowners and building occupants with 10 days' notice before proceeding with the Work.
- D. Protect structures near the Work, from damage.
- E. Prepare to place piles from excavated working elevation.

3.3 DRILLING

- A. Drill holes to facilitate driving only when piling cannot be completed in specified manner. Drill only through strata obstructing driving.
- B. Hole Diameter: Maximum 1 inch larger than tip dimension.

3.4 INSTALLATION

- A. Protect pile head during driving using collar, with full bearing on pile butt for even distribution of hammer blow.
- B. Deliver hammer blows to central axis of pile.
- C. When driving is interrupted before refusal, drive an additional 12 inches (300 mm) before resuming recording of performance data.
- D. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.
- E. Do not damage piles during driving operations.
- F. Cut off tops of piles to elevations indicated and prepare pile top to receive pile cap or grade beams.
- G. Prevent surface damage to treated piles.
- H. Apply preservative to exposed ends of cut-off piles in accordance with AWP A M4.

3.5 ERECTION TOLERANCES

- A. Section 014000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Vertical For Plumb Piles: Not applicable.
- C. Maximum Variation From Required Angle For Batter Piles: Not applicable.
- D. Maximum Variation From Design Cut-off Elevation: 2 inches.
- E. Maximum Out-of-Position: 2 inches.

3.6 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements 017700 - Execution and Closeout Requirements Field inspecting, testing, adjusting, and balancing.
- B. Request inspection of foundations in accordance with the International Building Code.
- C. Perform load tests as indicated.
- D. Test Piles: Same diameter and type as specified for other piling, placed in same manner.
- E. Accepted test piles may be used in the Work.
- F. Unacceptable Piles: Piles that fail tests, are placed out of position, are below cut-off elevations, or are damaged.
- G. Provide additional piles or replace piles to conform to specified requirements.

3.7 DYNAMIC PILE LOAD TEST

- A. Perform dynamic pile load test according to ASTM D4945.
- B. Prior to pile redriving, mark 2 feet (610 mm) in length of pile nearest ground or water surface in 1-inch (25-mm) intervals. Clearly mark depth with enlarged numerals at 6-inch (152-mm) increments.
- C. Conduct dynamic load test using the pile hammer system in the wave equation analysis conducted and submitted by dynamic testing consultant or geotechnical engineer and taking into consideration the pile geometry and soils in which the pile will be embedded.
- D. Conduct dynamic load test during initial drive and redrive of test piles.
- E. Conduct redrive at least 72 hours after completion of initial driving.
- F. Conduct redrive using a warm pile hammer. During redriving of test pile, testing agency will dynamically test pile hammer to verify that the hammer is delivering minimum specified energy to pile.
- G. Perform redrive sequence using dynamic testing apparatus with a hammer at normal operating temperature. Strike pile for 30 blows or until the pile penetrates an additional 3 inches (76 mm), whichever occurs first. In the event pile movement is less than 0.25 inch (6 mm) after 20 blows during redrive, redrive may be terminated.
- H. Perform pile wave analysis (CAPWAP or equivalent) on data obtained from initial driving and restrike of drive test piles.

END OF SECTION 31 62 19

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

The Contractor shall furnish all materials, labor, and equipment necessary to construct bituminous concrete paving as detailed on the drawings. Placement of base and pavement shall be performed after all embankment, fill compaction and testing is complete.

1.2 SUBMITTALS

- A. Certificates: Provide three (3) copies of materials certificate signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.3 JOB CONDITIONS

- A. Weather Limitations: Apply prime coats only when ambient temperature is above 50°F, and when temperature has not been below 35°F for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess amount of moisture.
- B. Construct asphalt concrete surface course only when atmospheric temperature is above 40°F, and rising, and when base is dry. Base and wedge course may be placed when air temperature is above 32°F and rising.
- C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.1 BASE COURSE

- A. Base course shall be graded aggregate, meeting the requirements of Sections 501 of the Maryland State Highway Administration Specifications.
- B. Base course materials shall be thoroughly compacted and final graded prior to placement of asphalt pavement. Work shall be performed per Maryland State Highway Administration Specifications. The Contractor shall pay for density testing performed on the subbase material. Testing shall be done during the early stage of compaction to allow adjustment in moisture content and compaction equipment.

2.2 ASPHALT PAVEMENT

Pavement shall be furnished and installed by the Contractor in accordance with Maryland State Highway Administration specifications. Pavement shall be installed in lifts as detailed on the plans. Asphalt shall comply with AASHTO T-49, penetration grade 85-100.

PART 3 - EXECUTION

3.1 INSPECTION

Paver must examine the areas and conditions under which asphalt concrete paving is to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Paver.

3.2 SURFACE PREPARATION

- A. Remove loose material from compacted base surface immediately before placing mix.
- B. Proof roll prepared base to check for unstable areas and areas requiring additional compaction.
 - 1. Notify Contractor of unsatisfactory conditions. Do not begin paving work until deficient base areas have been corrected and are ready to receive paving.

3.3 PLACING MIX

- A. General: Placing asphalt concrete mixture on prepared surface, as specified in Section 400 of Maryland State Highway Administration Specifications.
- B. Compaction: Use 5 to 8-ton Tandem Steel Wheel Rollers which comply with Section 400 of Maryland State Highway Administration Specifications.

3.4 FIELD QUALITY CONTROL

- A. General: Test in-place bituminous concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by the Owner.
- B. Thickness: In-place compacted thickness will not be acceptable if exceeding the following allowable variation from required thickness:
 - 1. Binder Course: 1/2", plus or minus.
 - 2. Surface Course: 1/4", plus or minus.
- C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:
 - 1. Base Course Surfaces: 1/4".
 - 2. Wearing Course Surfaces: 3/16".

3.5 PARKING AND LANE MARKINGS

- A. Cleaning: Sweep and clean the surface to eliminate loose material and dust.
- B. Striping: Use yellow chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.

1. Provide material complying with FS TT-P-115, type III.

C. Apply paint with mechanical equipment to produce uniform straight edges.

3.6 PAVEMENT MILLING

Milling shall be performed using a roto-milling machine with a proven record for use in milling hot-mix pavement. Contractor shall protect and adjust all valve boxes, manhole covers, catch basin grates, etc. which are in the area of proposed milling to match to the new pavement elevations.

A two inch (2") mill surface overlay is required for major repairs as noted on the drawings or required by the Worcester County Department of Public Works. Mill and overlay shall commence a minimum of one foot (1') beyond the outer limits of each utility patch in pavement. Mill and overlay will be minimum of one lane width. If the patch extends into a second lane, the mill and overlay must extend to cover the second lane entirely. Overlay shall not be less than two inches (2") of surface course material. Grades shall be reestablished to promote positive drainage.

END OF SECTION

SECTION 32 16 00

CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS - SURFACE RESTORATION

PART 1 - GENERAL

1.1 DESCRIPTION

The Contractor shall restore all surfaces damaged by their operations and install all new concrete, stone or asphalt paving to the width and extent detailed and noted on the plans or specified herein.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TOPSOIL AND SEEDING

- A. Topsoil shall be placed in areas where grass and vegetation has been disturbed by the Contractor's operations. Depth of topsoil shall be four (4") inches minimum. Topsoil salvaged and stockpiled during trench and structure excavation may be used for this purpose. When topsoiling all materials and methods of construction shall meet the provisions of other sections of these specifications.
- B. Seeding shall consist of furnishing and placing seed and soil supplements on topsoiled areas and at any other locations as directed by the ENGINEER. When seeding all materials and methods of construction shall meet the provisions of Section 705 of Maryland State Highway Administration standard specification.
- C. No separate payment shall be made for topsoil and seeding. The cost of this work shall be included in the appropriate prices bid.
- D. Topsoil, seeding and mulching shall be performed in accordance with permanent seeding requirements noted on the PROJECT plans.
- E. GUARANTEE
 - 1. Seeded areas shall produce a dense, well-established, and uniform stand of grass. Repair any eroded, dead, or bare areas until accepted by OWNER.
 - 2. Grass shall be allowed to reach a height of three (3") to four (4") inches, then the Contractor shall mow to a height of two (2") inches. The grass shall again be allowed to reach a three (3") to four (4") inch height and mowed to a two (2") inch height.
 - 3. Upon completion of second mowing, grass areas will be accepted by the OWNER providing the requirements herein have been met.

3.2 DRIVEWAY AND PARKING AREAS

- A. Driveways and parking areas disturbed through the Contractor's construction operations shall be restored in kind unless otherwise noted on the drawings. Cost for restoration shall be included in the linear foot cost for utility installation.

3.3 CONCRETE CURBS, SIDEWALKS AND DRIVEWAYS

A. General

1. The Contractor shall permanently repair or relay all curbs, sidewalks and driveways that have been removed, broken, or otherwise injured in executing any of the work under the contract or injured by settlement of any backfilled excavation at any time prior to termination of the contract and guarantee period.
2. Curb and sidewalk removed or damaged during construction shall be replaced in accordance with State of Maryland State Highway Administration Standards.
3. All concrete shall be according to Maryland SHA Section 902.10. All concrete placed shall reach a minimum compression strength of 4,000 PSI at twenty-eight (28) days.
4. Separate pavement for reconstruction of curbs, sidewalks and concrete driveways will not be made. However, cost shall be included within the appropriate unit and/or lump prices bid for furnishing and laying water mains and appurtenances.

B. Curbs

1. Concrete curbs, normal and depressed, shall be replaced in accordance with Maryland SHA Section 609 and as detailed on the drawings. Handicapped ramps shall be inserted in all areas where sidewalk is replaced at the corners of an intersection.
2. Curbs shall be depressed at all existing driveway locations in accordance with State Standard Details, including proper preparation of subgrade and proper placing and spacing of joints and joint materials.
3. Partial replacement, when so directed, shall extend to the nearest existing joint in each direction.

C. Sidewalks

1. Concrete sidewalks shall be replaced as required, or as directed, in accordance with Maryland SHA Section 610. Handicapped ramps shall be installed in all areas defined herein.
2. Sidewalks in areas not subject to vehicular loading shall have a minimum thickness of six (6") inches with fiber reinforcement of 1.25 pounds per cubic yard of concrete placed upon a properly prepared, graded and compacted subgrade.
3. Sidewalks in vehicular loading areas shall be a minimum thickness of six (6") inches with fiber reinforcement of 1.25 pounds per cubic yard of concrete and be reinforced with six (6") inch by six (6") inch wire mesh of 10-10 gauge. Subgrade shall be prepared as stated for non-load areas.
4. Replacement of partial sections of concrete sidewalk, where so directed, shall be extended to the nearest existing joint in each direction.
5. Sidewalks shall be replaced to a width as shown on the drawings and such width shall be maintained throughout the entire length of the block. In no instance shall the constructed width be less than four (4) feet.
6. A broom finish shall be applied perpendicular to the direction of traffic. All joint tool marks shall be removed.

3.4 GRADING

- A. Grading shall be by motor grader and to the limit defined. Re-grade and remove excess materials on existing street shoulders to permit positive drainage of stormwater from roadway.
- B. The Contractor shall dispose of all excess materials removed.

3.5 PARKING AND LANE MARKERS

- A. Use yellow or white chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.
 - 1. Provide material complying with FS TT-P-115, type III.
- B. Applying paint with mechanical equipment to produce uniform straight edges.
- C. All markings destroyed during construction operations to be replaced in-kind.

END OF SECTION

SECTION 32 31 00
FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide chain link fencing and gates for areas requiring separation.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1.03 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Chain-Link Fence Fabric:
 - 1. Mesh and Wire Size: 2 inch mesh, 0.148 inch diameter (9 gauge).
 - 2. Coating: ASTM A 817, Type 2, Class 1, zinc-coated (galvanized) applied after weaving.
- B. Framework:
 - 1. Galvanized steel, ASTM F 1083.
- C. Gates:
 - 1. Sliding type.
 - 2. Swinging type.
- D. Framing and Fittings:
 - 1. End, corner, and pull posts.
 - 2. Line and intermediate posts.
 - 3. Gate posts.
 - 4. Top rail.
 - 5. Tension wire.
 - 6. Tie wires.
 - 7. Post and line caps.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions and approved submittals. Comply with ASTM F 567. Install materials in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections. Install posts to depth to avoid frost heave.
- B. Cut pipe with pipe-cutters only. Cutting with backsaws is not acceptable. Tack weld gates for strength. Use spring loaded latches, not yokes.
- C. Restore or replace damaged components. Clean and protect work from damage.

END OF SECTION 32 31 00

SECTION 33 31 00

SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SCOPE

- A. The Contractor shall furnish all material and labor necessary to construct the pipelines and all required appurtenances at the locations and to the lines, slopes and elevations shown on the Drawings or designated by the ENGINEER. The contractor shall supply all necessary adaptors for connections to existing mains.

1.2 SUBMITTALS

- A. The Contractor shall submit six (6) copies of detailed materials listings and dimensional drawings for each size and type of valve, manholes, specialty, and appurtenances furnished.
- B. Submit six (6) copies of manufacturer's certifications to the ENGINEER that all pipe, fittings, and joints are as specified herein.
- C. Submit stakeout line and grade data to the ENGINEER.
- D. Submittals shall be in accordance with Section 01 33 00 - Submittals.

1.3 JOB CONDITIONS

- A. Existing Utilities: Locate existing underground utilities in the areas of work. Call "Miss Utility of Delmarva" (1-800-441-8355) and the OWNER and ENGINEER for assistance in locating existing utilities. If utilities are to remain in place, provide adequate means of protection during construction.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during work, consult ENGINEER immediately for directions as to procedure. Repair damaged utilities that are to remain in service.

1.4 PERMIT AND FEES

Comply with requirements regarding permits, fees, construction methods, inspection, approval, etc., of governing bodies having jurisdiction.

PART 2 - PRODUCTS

2.1 BURIED DUCTILE IRON PIPE AND FITTINGS

- A. Buried ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C-151/A21.51, latest edition and shall be minimum thickness Class 50 unless otherwise noted.
- B. Where called for on the drawings, piping shall have restrained joints. Acceptable restrained joints are as follows:

1. TR Flex by U.S. Pipe, Birmingham, Alabama.
 2. Super Lock by Clow, Oak Brook, Illinois.
 3. Mechanical joint with retainer glands and auto-torque screws by Standard International, Jacksonville, Florida.
 4. Approved equal.
- C. Where restrained joints are not required mechanical joints shall be provided. Joints shall be in conformance with the applicable requirements of ANSI/AWWA C 111/A21.11, latest edition. Joints shall be assembled in accordance with the manufacturer's recommendations.
- D. Buried Pipe and fittings shall have standard internal and external asphaltic coating approximately one (1) mil thick, per AWWA C-151.
- E. Buried service pipe and fittings shall have an internal cement lining in accordance with latest revision of ANSI/AWWA C104/A21.4 and ANSI/AWWA C110/A21.10, with the minimum thickness of cement mortar lining being 1/16-inch.
- F. All fittings and specials shall be ductile iron and shall be mechanical joint with a 350-psi pressure rating conforming to ANSI/AWWA C153/A21.53 and C111/A21.11. Wall thickness shall be equal to class 56 ductile iron pipe.

2.2 EXPOSED DUCTILE IRON PIPE AND FITTINGS

- A. Exposed ductile iron pipe shall be flanged, Class 53 and be manufactured in accordance with ANSI/AWWA C115/A21.15, latest edition.
- B. Exposed pipe and fittings shall have standard external asphaltic coating approximately 1 mil thick. Pipe and fittings shall have an internal cement lining in accordance with the latest revision of ANSI/AWWA C104/A21.4 and ANSI/AWWA C110/A21.10, latest edition.
- C. All exposed fittings and specials shall be cast or ductile iron with a 350-psi pressure rating and marked in conformance with ANSI/AWWA C110/A21.10, latest edition. Flanges shall be Class 125 in accordance with ANSI B16.1.

2.3 POLYVINYL CHLORIDE GRAVITY SEWER PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) pipe, used for gravity sewer construction, shall equal or exceed the requirements of ASTM D 3034 and shall have a maximum standard dimension ratio (SDR) of 35 and the minimum pipe stiffness, as tested in accordance with ASTM D 2412, shall be 45 when measured under 5 percent deflection at 73 degrees Fahrenheit.
- B. Polyvinyl Chloride wye branches, pipe stoppers, and other fittings shall be manufactured in accordance with the same specifications and shall have the same thickness, depth of socket, and annular space as the pipe. Tee fittings will not be permitted for use. Wye branches shall be complete pipe sections. Saddles will not be permitted for use.

- C. Polyvinyl Chloride (PVC) pipe shall be manufactured with integral wall bell and spigot joints which shall utilize an elastomeric O-ring gasketed joint conforming to ASTM D-1860. Pipe ends shall be beveled to accept gasketed fittings.
- D. Pipe shall be manufactured in lengths not to exceed 20 feet. Laterals shall have a minimum diameter of 6". Lateral shall not cross sewer main it connects into. Clean-outs shall include cast iron frame and cover.
- E. Polyvinyl Chloride Pipe shall be delivered and stockpiled in unit pallets. Stacking of pallets above 5 feet in height will not be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitably covered with reflective material to protect the pipe from ultra-violet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.
- F. Bowed sections of pipe will be unacceptable and installation of pipe which has bowed, whether or not the bow has been corrected, will not be allowed.

2.3 POLYVINYL CHLORIDE PRESSURE PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) pipe, used for pressure pipe applications, shall equal or exceed the requirements of one of the following as applicable: 1) AWWA C900/C905 and shall have a minimum dimension ratio (DR) of 18. It shall be manufactured in standard lengths not exceeding 20 feet. It shall have outside diameters equal to cast iron pipe. The pipe shall be rated for a working pressure of at least 150 psi.
- B. PVC pipe with integral bell by plain end design shall be connected by push-on method and shall utilize an elastomeric O-ring gasketed joint, that meets or exceeds the requirements of ASTM D 3139 and F477.
- C. All fittings for PVC pipe shall be compact ductile iron. They shall be mechanical joint with a 350 psi pressure rating conforming to ANSI/AWWA C-153/A21.53 and C-111/A21.11. Inside of fittings shall be cement lined with a bituminous seal coat in accordance with ANSI/AWWA C104/A21.4.
- D. The Contractor shall provide all necessary adaptors for connecting PVC pipe to cast iron fittings, valves, or other pipelines. Adaptors shall be recommended by the pipe manufacturer. Adaptors shall be rated for a working pressure of at least 200 psi. Cost for furnishing and installing adaptors shall be included in the unit prices bid for pipe installation.
- E. Polyvinyl chloride pipe shall be delivered and stockpiled in unit pallets and stored on a flat surface. No stacking of pallets above 5 feet in height will be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitably covered with reflective materials to protect the pipe from ultra-violet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.
- F. Cracked, crazed or deformed sections of pipe will be unacceptable and will not be permitted for installation on this PROJECT. Bowed sections of pipe will be unacceptable and installation of pipe which has bowed, whether or not the bow has been corrected, will not be permitted for installation on this PROJECT.

2.4 COUPLINGS

- A. The pipe couplings and expansion joints shall be of a gasketed, sleeve-type, with diameter to properly fit the pipe. They shall consist of ductile iron followers and middle end rings, rubber-compound gaskets, and sufficient stainless-steel bolts to properly compress the gaskets.
- B. Ductile iron shall meet ASTM A536. Gaskets shall meet ASTM D-395.
- C. The middle ring and follower of the coupling shall be true circular sections free from irregularities, flat spots, or surface defects. The follower-ring section shall be of such design as to provide confinement of the gasket.
- D. The gaskets of the coupling shall be composed of a crude or synthetic rubber base compounded with other products to produce a material which will not deteriorate from age, from heat, or exposure to air under normal storage conditions. It shall also possess the quality of resilience and ability to resist cold flow of the material so that the joint will remain sealed and tight indefinitely when subjected to shock, vibration, pulsation, and temperature or other adjustments of the pipeline.
- E. The couplings shall be rated for 200 psi working pressure. A sworn certificate of inspection and testing shall be furnished by the manufacturer.
- F. Transition couplings shall be style FC2A as manufactured by Ford Meter Box Company, Wabash, Indiana, or Style 253 by Dresser, Inc or approved equal. Couplings shall be sized for the specific application and installed per the manufacturer's recommendations.

2.5 PLUG VALVES

- A. Valves shall be of the non-lubricated eccentric type with an elastomer covering on all seating surfaces. The elastomer shall be suitable for the service intended. Flanged valves shall be manufactured in accordance with ANSI B16.1 Class 125/150, including facing, drilling and flange thickness. Mechanical joint ends shall be in compliance with AWWA/ANSI C-111-92. Ports shall be round with a minimum of 81% port area on sizes 2 ½" through 12" to facilitate "pigging" if required. Valves 14" and larger shall be of a rectangular port design with a minimum of 81% port area.
- B. Unless otherwise indicated, valve bodies shall be of ASTM A-126 Class B cast iron in accordance with AWWA C-504-87 Section 5.2.1. Valves 3" and larger shall be furnished with a welded-in overlay seat of not less than 90% nickel in accordance with AWWA C-507-85 Section 3.2.3.5. Sprayed, plated or screwed-in seats are not acceptable.
- C. Plugs shall be of ASTM A-536 Grade 65-45-12 in compliance with AWWA C-504-87 Section 2.2.2. The plugs shall be one-piece solid construction with PTFE thrust bearings on the upper and lower bearing journals to reduce torque and prevent dirt and grit from entering the bearing and seal area.
- D. Valves shall be furnished with replaceable sleeve type bearings conforming to AWWA C-504-87, Section 3.6.1 and AWWA C-507-85, Section 3.2.4. Bearings shall be of sintered, oil impregnated type 316 stainless steel ASTM A-743 Grade CF-8M. Valve shaft seals shall be of the "U" cup type in accordance with AWWA C-504-87, Section 3.7.2. Seals

shall be self-adjusting and repackable without removing the bonnet from the valve.

- E. Wrench operated valves 2 ½"-4" shall be capable of being converted to worm gear or automated operation without removing the bonnet or plug from the valve. All valves 6" and larger shall have worm gear operators as a minimum and automatic operator where indicated. All wrench operated valves and buried service valves shall be equipped with a 2" square nut for use with removable levers or extended "T" handles. Provide geared handwheel operators unless otherwise indicated.

Worm gear operators shall be of heavy-duty construction with the ductile iron quadrant supported on the top and bottom by oil impregnated bronze bearings. The worm gear and shaft shall be manufactured of hardened steel and run on high efficiency roller bearings.

Valves shall be designed and manufactured to shut off bubble tight at 175 psi for valves 2 ½" through 12" and at 150 psi for valves 14" through 36".

Each valve shall be given a hydrostatic and seat test with the test results being certified when required by the customer. Certified copies of Proof-of-Design test reports shall be furnished as outlined in AWWA C-504-87, Section 5.2.4 when requested.

Plug valves shall be Millcentric Series 601/600 as manufactured by Milliken Valve Company of Bethlehem, Pennsylvania, or equal.

- F. Install in manufacturer's recommended position.
- G. Valve opening and closing speeds shall be carefully selected to assure proper operation of other system components working in conjunction with the valve. It shall be the Contractor's responsibility to coordinate between all subcontractors and suppliers for a fully integrated control system.

2.6 MECHANICAL RESTRAINT FITTING FOR PVC PIPE

- A. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraint mechanism shall consist of multiple individually actuated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80.
- B. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest version. Twist off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices.
- C. The restraining glands shall have a pressure rating equal to that of the pipe on which it is used. The restraining glands shall have been tested to UNI-B-13-92, be listed by Underwriters Laboratories, and be approved by Factory Mutual. The restraint shall be the EBAA Iron Series 2000PV or approved equal.

2.7 MECHANICAL RESTRAINT FOR DUCTILE IRON PIPE

Restraint for DIP pipe and fitting shall be EBAA Iron Mega Lug Series 1100 or approved equal.
(See Specs in 2.7 above)

2.8 SEWAGE FORCE MAIN COMBINATION AIR/VACUUM VALVE

- A. The valve will be of the type that releases large amounts of air, gases, and vapor during the filling of the system and admits large amounts of air when the system drains to prevent vacuum damage to pipeline and accessories. The valve will be specially designed to operate with wastewater carrying solid particles which should not be expelled to the environment.
- B. The valve must release accumulated air from the system while the system operates under pressure, while maintaining an air pocket separation between the liquid and the working mechanism.
- C. Operating parts shall be corrosion-resistant polymer materials and float rod and spring made of stainless steel.
- D. The valve will have a conical shaped with optional 316 stainless steel body.
- E. The working pressures will be 3-150 psi.
- F. Air valve shall be A.R.I. Model No. D-026 Stainless Steel Combination Air Valve for Wastewater (Short Version), 2" valve size, or approved equal.
- G. Stainless steel nipples, tees, and valves shall be type 316 with threaded connections. Ball valves shall be quarter-turn, full-port.

2.9 PIPELINE DETECTION TAPE

Furnish and install pipeline detection tape as specified in Section 31 23 00 - Excavation and Fill.

2.10 THRUST RESTRAINT

Thrust restraint for all pressure and basin drain piping shall be accomplished by approved mechanical restraining joints where noted, or by thrust blocks as shown on the details. Restraint mechanisms shall be based upon a 1500 psi internal hydrostatic pressure and a 2000 pounds per square foot (psf) soil bearing pressure. Restrained joints which require destruction of pipe or gasket for disassembly shall not be used. All thrust blocks shall use 3000 psi concrete and shall be installed against undisturbed earth.

2.11 PIPE SUPPORTS

- A. All piping shall be supported by pipe supports and hangers, base fittings, and/or concrete pedestals in accordance with standard practice and to the entire satisfaction of the Engineer. Provide thrust blocks were called for on drawings and in accordance with standard practice and satisfaction of Engineer.
- B. All necessary pipe supports shall be provided and installed wherever shown on drawings and as needed to provide a complete piping system.
- C. All supports shall allow for expansion and contraction of pipe materials.
- D. Adequacy of size, spacing and type of supports shall be subject to the Engineer's approval.

- E. Before starting fabrication of the ductile iron pipe and fittings, the Contractor shall submit line drawings showing the location, dimensions and schedule of all pipe fittings, hangers, supports and appurtenances.
- F. A detail drawing of all supports shall be submitted to the Engineer for approval prior to the installation of the piping.
- G. On the ductile iron piping system, concrete floor supports shall be provided where feasible. Where concrete piers are not feasible, floor supports shall be heavy duty welded steel pipe. All floor supports shall include adjustable saddles, complete with screw or jack allowing final fractional inch adjustment.
- H. Where underground pipes leave or enter a structure or building, the Contractor shall take precautions to provide adequate support for such pipe over the span between the structural walls and undisturbed soil bearings. A pipe joint shall be located within two (2) feet of all structures. This can consist of special reinforced concrete support beams laid below the pipe or adequately spaced timber or metal posts located below the pipe and carried down to undisturbed earth.

2.12 PIPELINE TRACER WIRE

- A. For direct burial applications, wire shall be fastened directly to the top of the proposed force main. Tracer wire shall be a #12 AWG high strength, copper-clad steel (HS-CCS) conductor, insulated with a 30 mil, high-density, high molecular-weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be Copperhead HS-CCS HDPE 30 mil insulation as manufactured by Copperhead Industries, LLC of Monticello, MN.
- B. For directional drilling/boring, tracer wire shall be a #12 AWG extra high strength, copper-clad steel (EHS-CCS) conductor, insulated with a 45 mil, high-density, high molecular-weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. Insulation color shall meet the APWA color code standard for identification of buried utilities. Tracer wire shall be Copperhead SoloShot Extra High Strength, EHS-CCS HDPE 45 mil insulation as manufactured by Copperhead Industries, LLC of Monticello, MN.
- C. Splicing of tracer wire shall not be permitted. Tracer wire shall be terminated with magnetized tracer boxes. Tracer boxes shall be installed at each junction, dead end and at 500' intervals for long, straight runs. Boxes shall be installed directly above the proposed main and shall be rated for the surface condition in which it is installed. All boxes shall have a cast iron locking cover with color to match the APWA color code standard for identification of buried utilities.

2.13 TAPPING SADDLE

Tapping Saddle shall be stainless steel construction with six bolts and heavy-duty rubber seals. Saddle shall have triple bands with 2" and be Ford FS333-2260-TAP.

2.14 VALVE BOXES

- A. The Contractor shall provide each gate valve with a 5-1/4-inch diameter Buffalo type screw type valve box with "sewer" or "water" cast in the lids as appropriate. All boxes for 6-inch valves shall be equipped with #6 round base. Boxes for 8" valves shall be equipped with #8 round base 10 inch and larger valves shall be equipped with #160 valve box base. Valve boxes shall be adjustable between 2'-4" and 3'-4" except when deeper settings are required. Lids shall be extra deep and have two holes for removal of lid. Valve boxes shall be as manufactured by Mueller or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF SANITARY SEWER PIPE, FITTINGS AND APPURTENANCES

- A. Pipe, fittings, and appurtenances shall be installed per manufacturer's printed instructions. Care shall be taken to insure that no joints are made with uneven or rough edges. Pipeline deflection must be kept within the manufacturer's recommended deflection tolerance. Pipe and fittings shall be carefully handled and lowered into the trench. Special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the pipe. Where the contractor proposes to deviate from the specified instructions, the proposed deviation shall be submitted for approval.
- B. All pipes shall be bedded on a solid foundation prior to backfilling. Before pipe is placed, the bottom of the trench shall be carefully shaped to fit the lower part of the pipe exterior with reasonable closeness for width of at least sixty (60) percent of the pipe width. Bell holes shall be dug sufficiently large to insure the making of proper joints and so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Any defects due to settlement shall be made good by the Contractor.
- C. Pipe and fittings shall be kept clean until final acceptance of the work. All open pipe ends shall be provided with mechanical plugs to keep dirt, water, and other materials from entering. This plug shall be kept in place when actual pipe laying is not in progress.
- D. Excavation and backfill for pipes and appurtenances shall be in accordance with the applicable Sections of Division 2 of these specifications.
- E. The Contractor shall not install pipe on frozen or frost penetrated subgrade. When directed, the Contractor shall install pipe on artificial foundations. Such foundation may consist of gravel or concrete and shall be to the dimensions and in the manner directed by the ENGINEER. Refer to the applicable Sections of Division 2 of these specifications.
- F. Whenever a pipe requires cutting to fit into the line or to bring it to the required location, the work shall be done in a satisfactory manner so as to leave a smooth end perpendicular to the axis of the pipe. Field cut PVC pipe shall have a beveled edge before making the pipe joint.
- G. No welding or blocking will be permitted in laying any pipe unless by written order of the ENGINEER.

- H. Pipe laying shall not begin until all stakeout and cut sheets have been approved by the ENGINEER. Cut sheets for forcemains $\geq 4''$ diameter shall be staked at 100' intervals in addition to each fitting and valve. Gravity sewer runs will be staked at 50', 100', then at 100' intervals.
- I. Contractor is responsible for obtaining any temporary construction easements required to complete all work specified in this section.
- J. Pipeline detectable tape shall be installed continuously along all water mains. The tape shall be installed 12 inches above the water main and 12 inches from the ground surface. The tape shall be Lineguard Type III Detectable Tape as manufactured by Lineguard, Inc. of Wheaton, Illinois, or equal. The tape shall be a minimum of two inches wide, blue in color, imprinted with the words, "CAUTION -- WATER LINE BELOW", and be capable of being detected with inductive methods.
- K. All concrete required to construct buttresses behind plugs, tees, bends and other fittings and anchorages beneath the vertical bends shall be placed as directed and/or as shown on the plans. The cost of concrete buttressing shall be included in the appropriate unit prices bid for pipe and fittings.

3.2 LAYING PIPE IN FREEZING WEATHER

- A. No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the ENGINEER shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation unless all required precautions as to the minimum length of open trench and promptness of backfilling are observed.

3.3 ARTIFICIAL FOUNDATION

- A. Whenever directed, the Contractor shall lay pipe upon an artificial foundation which he shall construct. Such foundation may consist of gravels; sills, planks, or other timber construction, or of concrete; all to be of the form and dimensions and placed in the manner required by the ENGINEER.

3.4 INSTALLING FITTINGS, AIR VALVES, FORCEMAIN CLEANOUTS, GATE VALVES AND VALVE BOXES

- A. Fittings, air valves, force main cleanouts, gate valves and valve boxes shall be placed along the mains per the details and specifications at the locations indicated on the drawings or where otherwise designated by the ENGINEER.
- B. A valve box shall be carefully placed over the bonnet of each gate valve with the top at the finished surface of the street, sidewalk or at such other elevation as the ENGINEER shall direct. It shall be set exactly plumb. In tamping the backfill around the box special care shall be taken to keep the box plumb and to have it firmly supported on four 4-inch thick solid concrete blocks so as to avoid settlement. Any box which is found out of plumb, or which is not firmly supported, shall be excavated and reset in a satisfactory manner, at the Contractor's expense. Valve boxes shall not come in contact with the valve or the water main.

3.5 TESTING (PRESSURE PIPES)

A. GENERAL:

1. Contractor shall furnish all labor, tools, materials, and equipment, including water, pumps, compressors, stopwatch, gauges, and meters, subject to the approval of the ENGINEER for testing in accordance with these specifications. Water for testing shall be of potable quality.
2. The ENGINEER shall be notified a minimum of forty-eight (48) hours in advance of all tests, and all test and leak tested shall be conducted in his presence and to his entire satisfaction.

B. All pressure pipes shall be pressure tested as follows:
(Applies to all basin drain lines, all force mains, and all water pipes).

1. The Contractor shall furnish all equipment, labor and materials, including water, pumps compressors, stopwatch, gauges, and meters as approved by the ENGINEER for testing. The ENGINEER shall determine the amount of main to be tested at any one time and reserves the right to separate the installation into several test sections. All tests must be witnessed by the ENGINEER or OWNER. Forty-eight (48) hour advance notice shall be provided prior to testing.
2. Pressure Test - After the pipe has been laid, all newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure of 125 psi:
 - a. Test pressure shall:
 - i. Be of at least two (2) hour duration.
 - ii. Not vary by more than $\pm$ five (5) psi.
 - b. Pressurization: Each valve section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under the test corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the ENGINEER.
 - c. Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points, so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed, and the test pressure applied. At the conclusion of the pressure test all corporation cocks shall be removed and plugged or left in place as instructed by the ENGINEER.
 - d. Examination. All exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, or valves that are discovered following the pressure test shall be repaired or replaced with same material and the test shall be repeated until it is satisfactory to the ENGINEER.

C. Leakage Test

A leakage test shall be conducted concurrently with the pressure test and shall follow the requirements of AWWA C605, latest edition.

1. **Leakage Defined.** Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or at any valved section thereof, to return pressure to the beginning specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
2. **Allowable Leakage.** No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Where:

Q = quantity of makeup water, in gallons per hour

L = length of pipe section being tested, in ft

D = nominal diameter of the pipe, in in.

P = average test pressure during the hydrostatic test, in pounds per square in. (gauge)

Note that HDPE mains shall be tested in accordance with all pressure pipe testing requirements; however, the length of HDPE pipe shall not be included in the length of rigid pipeline(s) in the allowable leakage equation above.

3. Allowable leakage at various pressure is shown in Table I (appearing after this Subsection)
 4. When air valves are in the test section, the test shall be made against the closed valve.
- D. Should the test show the main to be defective, the Contractor shall remedy such defects and retest the main as specified above. This procedure shall be repeated until the rest of the requirements are met.

TABLE I

Allowable Leakage per 1000 feet of pipeline * - gph

Nominal Pipe Diameter (inches)

Ave. Test Pressure psi	4	6	8	10	12	14	16	18
150	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49
125	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36
100	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

- E. Contractor shall provide and install all temporary blowoffs and pressure taps as required for testing.

3.6 TESTING (GRAVITY SEWERS)

A. GENERAL

1. Contractor shall furnish all labor, tools, materials, and equipment, including water, pumps, compressors, stopwatch, gauges, flashlights or other artificial lighting, mirrors and meters, subject to the approval of the Engineer, for testing in accordance with these specifications.
2. The Engineer shall be notified in advance of all tests, and all tests shall be conducted to the entire satisfaction of the Engineer.
3. Sewer mains must pass all test requirements listed hereafter prior to acceptance by the Owner with no exceptions.

B. MANDREL TESTING OF SANITARY SEWERS:

1. All gravity sanitary sewer pipes shall be mandrel tested as follows. Excepted from this requirement is yard piping used for temporary by-passing.
2. Sanitary sewer pipe shall be deflection tested not less than 30 days after the trench backfill and compaction has been completed. The test shall be conducted by pulling an approved solid pointed mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the inside diameter of the pipe. The mandrel shall be a rigid, non-adjustable mandrel having an effective length of not less than its normal diameter.
3. Testing shall be conducted on a manhole to manhole basis and shall be done after the line had been completely cleaned and flushed. Any portion of the sewer which fails to pass the test shall be excavated, repaired, or realigned and retested with both air and deflection tests.

C. LEAK TESTING USING AIR:

1. Sewers shall be tested in sections not exceeding 400 feet in length unless otherwise approved by the Owner. Each section shall be tested immediately upon completion thereof. Each section shall meet the air pressure drop limitation specified herein.
2. All material and labor required for leakage tests shall be furnished by the Contractor.
3. Sewers shall be tested using the low-pressure air method in accordance with the requirements of ASTM C-828 and the Uni-Bell Plastic Pipe Association recommendations, based upon the Ramseier test time criteria. Procedural and equipment details shall be submitted to the Owner prior to acceptance of its use for testing.
4. If the test time for the designated size and length, elapses before the test pressure drops 0.5 psig, the section undergoing the test shall have passed.
5. If the pressure drops 0.5 psig before the appropriate test time has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. Contractor shall determine at their own expense the source or sources of leakage and they shall repair or replace all defective materials and/or workmanship to the satisfaction of the Owner. The completed pipe installation shall then be retested and required to meet the requirements of this test.

3.7 ADJUSTMENT OF UTILITIES AT GRADE

Contractor shall adjust all valve boxes and other appurtenant utility items to finished grade prior to paving.

3.8 DEFECTS TO BE MADE GOOD

If, at any time before the final acceptance of the Contract or during the guarantee period, any broken pipes, or any defects, are found in the piping system, valve arrangement or in any of their appurtenances, the Contractor shall cause the same to be removed and replaced by the proper material and workmanship, without extra compensation for the labor and material required, even though such injury or damage may not have been due to any act, default, or negligence on the part of the Contractor. All materials shall be carefully examined by the Contractor for defects, just before placing, and any found defective shall not be placed.

END OF SECTION 00 31 00

SECTION 43 23 58

LOBE PUMPS

1.1 SUMMARY

- A. Section Includes: Lobe pumps and accessories.

1.2 SUBMITTALS

A. Product Data:

- 1. Manufacturer information regarding materials of construction and fabrication, wiring diagrams, performance charts, and other details.

B. Shop Drawings:

- 1. Detailed dimensions for materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and other details.
- 2. Manufacturer's specified vibration displacement tolerances for pumps at operational speed.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of shop/factory tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of lobe pumps.

B. Operation and Maintenance Manual: Provide equipment specific manuals

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with ten (10) years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store pumps and accessories according to manufacturer instructions.

B. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.7 WARRANTY

- A. Furnish one (1)-year manufacturer's warranty for lobe pumps from official start up.

PART 2 - PRODUCTS

2.1 LOBE PUMPS

A. Manufacturers:

1. Borger, Blueline PL, PL200 Assembly
2. Or approved equal

B. Performance and Design Criteria:

1. Flow Rate: 40 – 80 gpm at 10 psi
2. See pump curve on Sheet C-506

C. Description:

1. Lobe Profile: Trilobed
2. Seal Type: Mechanical
3. Maximum Speed: 185 rpm.
4. End Connections: Flanged, ASME B16.5

D. Operation:

1. Electrical Characteristics:
 - a. 5 HP
 - b. Voltage: 208-230/460V three phase, 60 Hz.

E. Materials:

1. As recommended by manufacturer for service liquid.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Startup and Performance Testing:

1. Operate pump using clear water for 10 continuous minutes in presence of Architect/Engineer.
2. Verify pump performance by performing time-drawdown test or time-fill test.
3. Check pump and motor for high temperature and excessive vibration.
4. Check for motor overload by taking ampere readings.

B. Equipment Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

3.2 DEMONSTRATION

A. Demonstrate pump startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 43 23 58

SECTION 47 76 21 BELT FILTER PRESS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The bidder shall furnish, deliver, and start-up, one (1) 2.0m 3-belt press dewatering system (referred to as "system" or "belt press system" or "dewatering system") and associated equipment as specified herein and in accordance with the Contract Documents. The belt press equipment specified in this section shall be provided by a single supplier to ensure coordination and compatibility of equipment.
- B. The belt press manufacturer is advised to familiarize themselves with the overall plant process in order to evaluate the compatibility of the manufacturer's equipment to dewater the particular water treatment sludge generated.
- C. The bidder shall provide one (1) complete Belt Press dewatering system as specified herein. The system shall include the following: belt press, polymer system, control panel, water supply booster pump, discharge conveyor and totalizing flow meter. The belt press system must be complete and integrated such that it can operate in a fully interlocked manner while achieving the performance requirements as specified in this document.
- D. The dewatering system shall be designed to thicken and dewater aerobically 100% waste activated waste water treatment sludge by means of a belt press with 3-belt design. The connected ancillary equipment shall be supplied by the Belt Press Manufacturer to ensure system compatibility and system responsibility.

1.2 ACCEPTABLE MANUFACTURER

- A. The bidder shall be furnish and start up Belt Press equipment as manufactured by BDP Industries, Inc., or approved equal.
- B. The Contract Documents are based upon the specific dimensions and operating characteristics of the products of the manufacturer stated. Exact details of construction, operating clearances, and the like may differ between manufacturers. Provision of equivalents or substitutes, therefore, may require partial re-design or modifications of associated facilities (i.e. piping arrangement, structural dimensions, etc.), which shall be at the Contractor's own expense and shall require approval by the Engineer.
- C. It is the intent of these specifications that a single manufacturer-supplier, regularly engaged in the design, manufacture, assembly, and production of dewatering equipment, shall have complete responsibility for furnishing, coordination, and supervision of all components of the system described in this section. It is also intended that such a manufacturer-supplier make all adjustments, alterations, replacements, and tests specified and required, for a complete satisfactory, and trouble-free operating installation. The single source supplier shall provide a performance affidavit stating strict compliance with the specifications and accepting system responsibility. Furnishing of the equipment other than from a single supplier will not be allowed.
- D. General:
 - 1. In order to centralize responsibility, it is required that all equipment provided under this Section

be obtained from a single supplier or manufacturer who shall assume full responsibility for the completeness of the system. The supplier or manufacturer shall be the source of information on all equipment furnished regardless of the manufacturing source of that equipment.

2. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the pump equipment manufacturer.
- E. Any equipment submitted other than listed above will be considered a substitute and will not be considered.

1.3 PERFORMANCE CRITERIA

- A. Belt Press Operational Requirements: The Belt Press (referred to as "belt press" or "press" in the remainder of this document) shall meet the following operating parameters when processing the sludge specified.

1. The solids shall be derived from an aerobically digested aerobically digested sludge with a concentration of 2% to 3%.
2. The belt press unit shall be capable of meeting the performance criteria as set forth below:

PARAMETER	High Cake Solids	High Throughput
Maximum Sludge Feed Rate (GPM)	66 - 100	133 - 200
Solids Loading (lbs/hr)	1,000	2,000
Maximum Polymer Dosage (act. lb/dry ton)	16 - 20	16 - 20
Minimum Discharge Cake Solids (%wt)	17	15
Minimum Solids Capture (%)	95	95

- B. Process Performance Test and Guarantee

1. The belt press equipment shall be tested separately at both conditions listed above. The high discharge cake condition must include a minimum of 6 hours of testing with a minimum of 3 sets of samples collected. The high loading rate condition must include a minimum of 3 hours of testing with a minimum of 3 sets of samples collected.
2. There will be a performance test for the dewatering test:
 - a. Once a representative sludge has been established, the manufacturer shall operate the press at or above the required flow rate and solids loading for a minimum period of 6 hours with samples of feed, discharge cake, and filtrate collected hourly. Samples will be analyzed per ASTM standards for total suspended solids (TSS) and total solids (TS), and the results averaged. The average cake solids must exceed the above requirements in order to demonstrate compliance. The average polymer dosage must be less than the above requirements in order to demonstrate compliance. Should the belt press fail to meet the minimum standards specified, the following shall occur:
3. Plant operating procedures shall be reviewed to determine that the sludge is in fact representative of normal operation and within the design specifications.
4. If it is determined that the sludge is representative and within these specifications, the manufacturer shall make any modifications necessary to accomplish the specified performance

levels.

5. If the sludge can be demonstrated as representative and within specified parameters and if the manufacturer cannot meet the performance, the owner may elect to have the manufacturer remove the unit and refund any monies paid.

1.4 SUBMITTALS

- A. The supplier shall submit a complete list of equipment and materials required for shop drawing or submittal approval. The term “shop drawing” as used herein shall be understood to include detailed arrangement drawings, foundation layout drawings, control drawings, hydraulic controls systems, catalog sheets and similar items.
- B. Unless otherwise required, these drawings shall be submitted in sufficient time to be reviewed by the ENGINEER, and to accommodate the construction schedule required under the contract.
- C. The manufacturer shall furnish five copies of shop drawings in three ring binders to the engineer. Submitted packages shall include a complete bill of materials for all equipment, recommended spare parts list, list of any deviations from the contract documents and a statement of machine warranties.
- D. The belt press manufacturer shall submit ten projects in which they supplied same exact type and model three belt units on aerobically digested sludge. The engineer reserves the right to reject any and all manufacturers based on the references provided on the past projects.
- E. All pressure section frame, pressure section bearing and press section roller calculations shall be completed and stamped by a US State professional engineer and must be included in the equipment bid. All calculations shall be based on maximum design belt tension of 70 PLI (lbs per lineal inch of belt width) or total of 280 PLI for both belts at a belt speed of 5 meters per minute. Roller deflections shall be completed for all eight compression rollers including the perforated roller and drive rollers. These calculations shall be signed and sealed by a professional engineer licensed to practice in the New York.
- F. Submit shop drawings and product data required to establish compliance with this Section. Submittals shall include the following:
 1. Certified shop and erection drawings showing all important details of construction, sludge feed, wash water, drainage connections, wiring diagrams, itemized motor horsepower, dimensions and anchor bolts.
 2. Descriptive literature, bulletins and/or catalogues of the equipment. This material shall include, but not be limited to, the following:
 - a. Functional description of internal and external instrumentation and controls to be supplied, including list of parameters monitored, controlled or alarmed and testing plan.
 - b. Materials of construction and of all coatings of all major components, including bearings. Include sizes of materials and thickness of coatings.
 - c. Details of the drive system for belts.

- d. Details of the static sludge/polymer mixer supplied.
- e. Information on field erection requirements, including total weight of assembled components, weight of the single largest component that will require removal during the life of the unit and gross operating weight.
- f. Statement of roller, bearing, frame and belt guarantees for units furnished. Also, describe typical range of belt tension and recommended belt tension for this application.
- g. Total connected nameplate horsepower and operating horsepower for each belt press dewatering system motor. Itemize this information for each motor. Include motor data as required by Section 01 60 01.
- h. Statement of water requirements (flow and pressure) and any other utility requirements.
- i. Description of gravity drainage and low, medium and high pressure stages.
- j. For the baseplate of the belt filter press, furnish the loads including all horizontal and vertical components as follows:
 - 1) Deadloads due to unit weight empty.
 - 2) Deadloads due to unit weight full of sludge, drain pans full and similar circumstances.
 - 3) Dynamic loads.
 - 4) Combination of 2) and 3) above.
 - 5) Loads exerted during belt changing procedures.
- k. Control panel elevation drawings showing construction and placement of operator interface devices and other elements. Control panel data to include:
 - 1) Dimension and layout details.
 - 2) Materials of construction.
 - 3) Brand names and catalog literature on all control devices such as, but not limited to:
 - a) Fused disconnects
 - b) Thermal Magnetic Circuit Breakers
 - c) Motor starters
 - d) Motor Circuit Protectors

- e) Terminal blocks
 - f) Fuse blocks
 - g) Variable Frequency Drives
 - h) Audible and Visual Alarm Indicators.
 - i) All switches, pushbuttons and lights
 - j) Timers, relays and related equipment
 - k) Programmable logic controllers (PLC)
 - l) Surge Protection
 - m) Enclosures
- l. A complete total bill of materials for all equipment.
 - m. A complete parts list, showing current price and delivery time for each part. Include manufacturer's recommended spare parts and a firm price quotation good for one (1) year after Substantial Completion.
 - n. A maintenance schedule, showing the required maintenance, frequency of maintenance and lubricants and other items needed at each regular preventive maintenance period.
 - o. Provide certified safety factor calculations as described in Paragraph 2.03 below for structural frame, roller bearings and roller shafts, as well as maximum roller and frame deflection based on maximum design belt tension of 70 PLI (lbs per lineal inch of belt width) or total of 280 PLI for both belts at a belt speed of 5 meters per minute. These calculations shall be signed and sealed by a professional engineer licensed to practice in the New York.
 - p. Complete data on motors and controls as specified in Paragraph 2.05 below.
 - q. Addresses for alarms/data to SCADA.
 - r. Cut sheets on wash water booster pump and motor.
- G. In the event that it is impossible to conform to certain details of this Section due to different manufacturing techniques, describe completely all non-conforming aspects.
 - H. Submit to the Engineer operating and maintenance data as specified. Manuals shall be provided for all BFP related equipment specified in this or other Sections. This data shall be prepared specifically for this installation and shall include all necessary Drawings, equipment lists that are required to instruct operations and maintenance personnel unfamiliar with such equipment. Approved operating

and maintenance data shall be available and used during the period of operation and maintenance instructions provided by the equipment manufacturer.

I. Shop Drawings:

1. Manufacturer's literature, illustrations, specifications and engineering data including dimensions, materials, size, weight, performance data and curves
2. Installation diagrams showing location, arrangement, and size of all anchor bolts required for the equipment, if applicable.
3. Wiring diagrams showing all electrical connections to the motors and controls.
4. Motor HP, rpm, insulation and enclosure details, and efficiency at full, 3/4 and 1/2 load.
1. Prior to fabrication, manufacturer shall submit data for review and approval.
2. Submittal shall include shop drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor data, and pump curves including hydraulic brake horsepower (BHP).
3. Submit certified pump curves to include efficiency and horsepower curves for pump and motor.
4. Outside utility requirements, such as water, power, air, etc.
5. Functional description of any internal instrumentation and control supplied including list of parameters monitored, controlled, or alarmed.
6. Addresses and phone numbers of nearest service centers and a listing of the manufacturer's or manufacturer's representatives' services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repair services.
7. Detailed information on site, architectural, structural, mechanical, plumbing, electrical, and control, and all other changes or modifications to the design and construction work necessary to adapt the equipment or systems to the arrangement shown and/or functions described on the drawings and in the technical specifications. This shall include plan view and section sketches illustrating any additional space requirements necessary to provide the minimum adequate clear space within and around the equipment for operation and maintenance, as shown on the drawings and specified.
8. A completed and signed affidavit from the manufacturer certifying dewatering performance to performance criteria listed in Section 1.3 of this specification.

B. Shop Drawings:

1. Manufacturer's literature, illustrations, specifications and engineering data including dimensions, materials, size, weight, performance data and curves
2. Installation diagrams showing location, arrangement, and size of all anchor bolts required for the equipment, if applicable.
3. Wiring diagrams showing all electrical connections to the motors and controls.
4. Motor HP, rpm, insulation and enclosure details, and efficiency at full, 3/4 and 1/2 load.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, but lack experience on exact equipment supplied.

2. Three (3) copies of operation and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include detailed operating and maintenance instructions and specifications relative to the following; assembly, alignment, checking, lubrication, placing in operation, adjustment, maintenance of each unit of equipment, auxiliaries furnished under this contract, together with complete parts lists, and copies of dimension drawings.
3. Documentation shall be specific to the pump supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the pump manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:
 - a. Functional description of each major component, complete with operating instructions.
 - b. Instructions for operating equipment.
 - c. Calibration and adjustment of equipment for initial start-up, or as required for routine maintenance
 - d. Support data for commercially available components not produced by the manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacture r and incorporated as appendices.
 - e. Mechanical layout drawing of the equipment and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of equipment.
4. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

D. Contract Closeout Submittals:

1. Equipment Operation and Maintenance Data.
2. Manufacturer's warranty
3. List of recommended spare parts and tools for an operating period of one year. The list shall describe each part, the quantity recommended, and the unit price of the part.
4. Submit a written equipment alignment report for each unit.
5. Submit a written field startup report giving the results of the required field tests.
6. Submit written report of the results of each visit by a manufacturer's serviceman, including purpose and time of visit, tasks performed, and results obtained.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer shall have a minimum of twenty years' experience producing identical equipment and shall be able to show evidence of at least ten installations of 3-belt units of 2.0m width (effective width), manufactured to 70 PLI design standards that meet the structural requirements of this specification. The reference installations must have been in satisfactory operation for at least five years. Upon request by the engineer, the manufacturer shall provide proof of such

experience by providing installation lists, including calculations supporting the 70 PLI design that are sealed by a professional engineer. These calculations shall include the frame safety factor, bearing life and roll deflection, with calculations verifying that the design exceeds the requirements of this specification.

- B. These specifications include certain areas affecting process functions, operation and maintenance reliability under which no exceptions shall be allowed. These are as follows:
 - 1. Valmet Consistency Meter.
 - 2. High Strength Tubular Steel Frame Construction
 - 3. Up-Flow Feedbox
 - 4. Variable Speed Paddle Wheel Distributor
 - 5. Independent Variable Speed Gravity Drainage Section at Operator Level
 - 6. Curved Wedge Zone
 - 7. Vertical Pressure Section
 - 8. Machined Bearing Pads
 - 9. Double Flange Roll Construction
 - 10. 70 PLI Self-Compensating Hydraulic Tensioning System
 - 11. Rack and Pinion Tensioning in Pressure Section.
 - 12. Mist Noise Reduction Shower Box.
 - 13. Dual Press Drive Motors in the Pressure Section
 - 14. Smart tensioning position sensors.
 - 15. Hot-Dipped Galvanized Corrosion Protection System
 - 16. UV resistant primer and urethane top coat.
- C. The equipment manufacturer must meet all of the following criteria:
 - 1. The belt press manufacturer shall supply a list of at least fifty (50) equipment installations that they have completed in the United States of the exact model and type. This shall be included in the equipment bid with contact names and phone numbers.
 - 2. The belt press shall be manufactured by a US corporation. All manufacturing shall be completed in-house by the belt press manufacturer in the United States. No manufacturing shall be out sourced or purchased from outside companies.
 - 3. The manufacturer shall design, build, program and test the control panel at their facility and must be a UL508 certified panel shop. The manufacturer shall have a minimum of 20 years of experience as a UL panel shop.
 - 4. Full certified service manufacturing center located within 425 miles of Ocean Pines, MD. The service center shall include factory certified technicians, spare parts, welding and machine shop capabilities. The service center shall be an established business with over 20 years in the belt press service industry. The belt filter press supplier must be capable of supplying emergency service within 24 hours' notice.
 - 5. All buy-out items on the belt press shall be standard off-the-shelf mounts. The belt press manufacturer must also supply all of the original part numbers for all original equipment manufacturers' buy-out items as well as a list of local suppliers located near the installed location.
- D. Upon request from the engineer, the manufacturer shall prove financial stability and ability to produce the equipment within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.
- E. The bench testing must be conducted with a representative sludge sample sent to the belt press manufacturer lab for testing.
- F. The manufacturer must make a site visit to insure that the proposed unit fits in the existing belt press room prior to being considered as an alternate supplier.
- G. The BDP Belt Press system described herein and shown on the drawings establishes a standard of

required type, function and quality to be met. No “or-equal” system shall be considered by the Engineer. Any alternate equipment suppliers shall be submitted for approval 14 days prior to Bid. The submittal shall include a complete equipment submittal including room layout drawings, bench test report, electrical drawings, equipment design calculation, component catalog cuts, contact list and performance guarantee. All exceptions shall be clearly identified by the manufacturer with a cost to supply the component specified. Any exceptions not identified will lead to immediate rejection of the submittal by the engineer and owner. The cost of the engineer review shall be paid by the contractor submitting the alternate substitution. The cost of the review shall be billed at \$350 per hour. A minimum of 40 hours will be required to review each alternate equipment submittal. The burden of proof of merit for the proposed item is upon the prospective bidder. Any modifications to the contract drawings that are required for the alternate units shall be borne by the installation contractor. The engineer and owner reserve the right to reject any and all alternate requests based upon on their review.

- G. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.6 MANUFACTURER'S WARRANTY

- A. Provide a two (2) year non-prorated warranty covering all defects in materials and workmanship. Warranty shall be in effect from the date of acceptance by the owner. Provide a five (5) year non-prorated warranty covering the frame, frame coating, rollers, roller coatings, bearings and bearing housings.
- B. Warranties by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer shall assume prime responsibility for the warranty of the complete system.
- C. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.
- D. In the event the component fails to perform as specified or is proven defective in service during the warrantee period, the manufacturer shall provide a replacement part without cost to the owner. The manufacturer shall further provide, without cost, such labor as may be required to replace, repair, or modify major components such as pump, pump motors, controls, etc.
- E. The manufacturer shall supply the services of a factory trained technician to inspect the installation, test the equipment for proper performance start up and instruct maintenance personnel on the operation and care of the system.

PART 2 PRODUCTS

2.1 GENERAL

- A. The equipment covered by these specifications is intended to be belt press dewatering equipment of proven ability as manufactured by reputable concerns having long experience in the production of

such equipment. The equipment furnished shall be designed and constructed in accordance with the best practice and methods.

- B. All components of the system shall be engineered for long continuous and uninterrupted service. Provisions shall be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable. Except as otherwise specified, steel plates and shapes shall have a minimum thickness of ¼" and bolts shall have a minimum diameter of ½."
- C. All welding shall be in accordance with the latest acceptable codes of the American Welding Society ANSI/AWS D1.6.
- D. All material used in the construction of the sludge dewatering equipment shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the ASTM standard specification for structural steel, designation A500. All iron casting shall conform to the ASTM standard specification for gray iron casting, designation A48-76, and shall be of a class suitable for the purpose intended. Other materials shall conform to ASTM specifications where such specifications exist; the use of such material shall be based on continuous and successful use under the similar conditions of service.
- E. Unless otherwise specified herein, all metal parts in contact with or subject to splashing polyelectrolyte or sludge shall be type 316L stainless steel. All fasteners, pins, and anchor bolts shall be type 316L stainless steel.
- F. All fiberglass-reinforced plastics (FRP) shall be manufactured in conformance with NBS standards PS15-69.

2.2 SURFACE PROTECTION

- A. All metals shall be hot dipped galvanized to the latest revision of ASTM 123 specification. Flame sprayed galvanizing shall not be allowed.
- B. After galvanizing the frame will be primed and top coated with a UV resistance urethane top coat.
- C. All pre-painted purchased equipment such as electrical motors, cylinders, gearboxes, etc., shall be painted with a final coat of the below system. All miscellaneous steel items shall be sandblasted and covered with the following paint system:
 - 1. First coat of Tnemec #66 primer epoxy of contrasting color to a minimum of four (4) dry mils thickness.
 - 2. Second coat of UV resistant Urethane Top Coat, finished color, minimum of four (4) mils thickness. Total thickness of the two (2) coats will be a minimum of eight (8) mils dry.
- D. The control panel enclosure shall be NEMA 4X constructed of type 316 stainless steel. Inside of the box will be white.

2.3 MECHANICAL DETAILS

- A. Main Structural Frame
 - 1. The frame shall be fabricated from tubular steel structural members designed to support all components and accessories. Steel shall meet the requirements of ASTM A500; all welding shall be performed in accordance with ANSI/AWS D1.1. Where frame components are bolted,

stainless steel fasteners shall be used. The frame moment of inertia shall be a minimum of 59.9 in.⁴ in the xx axis and 20.1 in.⁴ in the yy axis. The load bearing frame member of the pressure section shall have a moment of inertia minimum of 180 in.⁴ in the xx axis and 38 in.⁴ in the yy axis. Channel, plate or I-beam construction will not be accepted.

2. The fabricated steel frame shall be designed to withstand the maximum stresses imposed on the individual members with a safety factor of 20. Specifically, the maximum actual stress on any member, connection, plate, etc., shall not exceed 1/10 of the yield strength of the frame material used. The deflection ratio of any structural member shall not exceed L/600 where L is the member span. The tension used for the calculations shall be a minimum of 70 lbs. per linear inch (280 PLI Total in pressure section) of actual belt width.
3. Drip pans shall be fabricated of a minimum 14-gauge type 304L stainless steel and shall collect filtrate from all gravity and pressure sections.
4. The framework shall be constructed in such a manner that shall insure absolute plane parallelism of all rolling elements by machined bearing pads.
5. The framework shall be of welded and/or bolted construction. No disassembled component, excluding the belt filter frame, shall weigh more than 3,500 lbs.
6. Adjustable leakage seals shall be provided to contain the sludge on the belt through the gravity drainage zone. Seals shall be 304 stainless steel with rubber skirts, designed to provide an effective seal without causing wear to the belt.

B. Flocculation/Conditioning System

1. To achieve rapid contact between sludge particles and a solution of dilute polyelectrolyte provide:
 - a. A static, in-line, adjustable energy non-clogging Venturi mixer shall be provided. The mixer shall be equipped with a Vortex polymer injection ring with four (4) tangentially mounted polymer injectors. The mixer shall be located upstream of the belt filter press. The belt filter press manufacturer shall recommend the proper layout of the system based on actual field conditions. The manufacturer shall provide spool pieces as required for alternate locations. The in-line Venturi mixer shall be fabricated entirely of 316L stainless steel with an adjustable open throat area. The mixer shall include a removable side plate for inspection and maintenance.
 - b. Mixer shall include a pressure sensor at the inlet of the venturi mixer to measure inlet pressure in the line and automatically vary the back pressure of the inline mixer. A separate high pressure switch shall be supplied in an isolation ring. The operator shall be able to set the back pressure on the OIT.
 - c. (OPTIONAL ADDER) The belt press manufacturer shall supply a Valmet TS 4" consistency inlet Sensor model FT DN100/JIS with Bridge Display - Digital Touchscreen Display includes 10m/33ft cable. The meter shall communicate back to the PLC/OIT belt press control panel. The operator shall be able to auto pace the sludge pump based on the feedback from the consistency meter.
 - d. An up-flow feedbox shall be provided after the Venturi mixer to insure optimum sludge conditioning. This feedbox shall be vertically baffled and discharged into a stainless steel distributor. The feedbox assembly shall extend across the full width of the belt press and shall be fabricated of type 304 Stainless Steel.

C. Independent Gravity Drainage Area

1. The press shall be furnished with an independent gravity drainage area consisting of a variable speed belt designed to contain and drain conditioned sludge. An inlet distributor shall be

provided to evenly distribute the conditioned sludge over the face of the moving filter belt. The inlet shall incorporate a variable speed, 6-blade paddle wheel distributor across the full width of the belt press. The feed distributor must form a uniform slurry depth over the full belt width immediately upon leaving the feed distributor of plus or minus 1/16 inch. The paddle wheel shall be driven by a 1/3 HP AC/VFD TEFC motor and gearbox. The belt system shall be sealed to prevent leakage and shall be easily accessible for operating, viewing, cleaning, and adjusting. Units without the paddle wheel distributor will not be considered.

2. All materials in contact with the sludge in the distributor area shall be 304L stainless steel with adjustable angle furrowing plows of UHMW plastic.
3. The gravity drainage area shall have a minimum horizontal area of 65 ft². The gravity drainage area shall be supported by slide strips. Supports shall be designed to prevent deflections greater than 0.05 inches with a loading of 100 lbs. per square foot. Slide strips shall be easily removable without disassembly of any components.
4. The belt support shall be a series of UHMW wear strips within a 304 stainless frame, spaced every 6" and be of a design to support and enhance gravity dewatering. The UHMW wear strips shall be supported every 6 inches by 1/4" x 3" 316 stainless steel bar support. Each deck section shall be adjustable height to provide extended life of the wear strips and sludge containment seals. Only systems, which have been demonstrated as effective in the area, shall be considered.
5. Adjustable leakage seals shall be provided to contain the sludge on the belt through the gravity drainage zone. Seals shall be neoprene rubber with 304 stainless steel deckle supports, designed to provide an effective seal without causing wear to the belt.
6. Eight rows of swing up type furrowing plow devices shall be supplied in the gravity drainage section and shall be readily removable. The first two and the last two row shall be of the "Foil Doctors" design and two intermediate rows shall be an adjustable furrowing type.
7. The adjustable plows shall be mounted on a support system that can be raised for cleaning via lifting handles.
8. The Foil Doctor design shall consist of a UHMW plastic doctor blade configuration with the doctor blade held flat against the filter cloth and the knife edge pointing toward the feed box. The doctor blade shall be a minimum of 2 inches wide. Plastic supports at 12 inches spacing across the width from an overhead galvanized steel support assembly shall hold the doctor blade flat against the filter cloth. The whole assembly shall be designed to rotate up and away from the cloth.
9. Plows shall be high-density polyethylene with hot dipped galvanized support holders. Plow position shall be adjustable from 0 to 30 degrees with respect to the direction of belt travel. All plows shall be adjustable in unison for each plow row. To facilitate cleaning, each row of plows shall include a single-lifting handle; designed to raise the entire row of plows a minimum of six inches from the belt.
10. The plows shall be automatically lifted by a hydraulic lift cylinder that is controlled by the operator at the OIT on the control panel. The lift cycle shall be adjustable on frequency and duration of each lift.
11. The independent gravity drainage area shall be equipped with a variable speed drive, powered and controlled from the main press panel.
12. The gravity drainage area shall incorporate an independent belt speed at operator level without the use of catwalks or rolling ladders for operations or maintenance. The gravity belt height shall not exceed four feet. All other gravity section designs shall not be permitted.

13. The independent gravity drainage area shall be provided with a hydraulic tension and tracking system as specified. Manual tensioning or tracking systems shall not be permitted.
14. The gravity zone discharge shall be designed for a future dual mode operation of the belt press. The gravity zone shall have the electrical limit switch and transition chutes included in the scope of supply to allow the owner the ability to add a future TWAS conveyor. The thickening mode shall be included prewired to the junction box and shall have the necessary controls in the press control panel including PLC inputs, outputs and prewired circuit breakers.

D. Curved Wedge Section

1. The belt filter press shall be furnished with a distribution chute to receive sludge from the primary gravity dewatering section for purposes of even distribution of the sludge to the wedge section.
2. The wedge zone shall have automatic level control that the operator can you to automate the belt speed or the sludge feed rate of the sludge pump to the press. This control shall be completed at the press control panel OIT.
3. The wedge section shall be of a curved belt path design, straight belt path designs will not be allowed. The initial radius of curvature shall be a minimum of 24-inch radius and transition to a final radius of curvature of 16.5 inches. The curved section must be a minimum of 56" in length. The wedge section design shall provide gradual cake pressure through the zone to enhance dewatering. The wedge section shall be supported by construction equal to that of the gravity belt section, shall be a minimum of 2 inches wider than the width of the belt and designed to reduce belt wear.
4. Movement through the wedge section shall be designed to insure a uniform layer of sludge across the entire working width of the belt. It shall be adjustable to allow operator determination of proper relationship between belt speed and cake height, in order to insure optimum dewatering.
5. The materials in contact with the sludge and/or subject to splashing shall be fabricated from type 304L stainless steel. All fasteners, along with mounting and adjustment hardware shall be 304L stainless steel.
6. Units without curved wedge zone sections shall not be permitted.
7. The wedge section shall consist of a curved wedge that shall allow for a gradual pressure increase on both belts to enhance dewatering. The wedge section shall be supported by construction equal to that of the gravity belt section, shall be a minimum of 2" wider than the width of the belt, and designed to reduce belt wear.
8. The wedge section shall have a minimum horizontal area of 40 ft². This calculation is based on only one belt. Vertical wedges or non-curved wedges will not be accepted.
9. The curved wedge zone configuration shall include a tray beneath each roll such that the filtrate is removed from the sludge cake without filtrate hitting the return belt. Each drip pan shall be constructed of 304L stainless steel and directed to a final collection pan and piped to the sump area. The collection pans shall eliminate filtrate from landing on the returning belt.

E. Vertical Pressure Zone

1. The vertical belt filter press shall be furnished with a pressure zone following the wedge section drainage area.
2. The pressure section shall become uniform at the tangent of the first low pressure, 304L stainless steel, and perforated drainage roll. It shall be a minimum of 20" in diameter, followed by a 16" diameter reversing turn, completing a full S with each turn exceeding 200 degrees.
3. The next stage of the pressure zone shall consist of an arrangement of a minimum of five (5)

rollers developing a continued 200 degree S-shaped belt travel. The rolls shall decrease from 12" in diameter to 10" in diameter.

4. The decreasing roll diameter shall provide an increasing pressure profile in the pressure zone, made adjustable by changing the belt tension.
5. The seventh and eighth roll in the pressure section shall be 10" diameter drive rollers forming the last 200 degree turn.
6. The minimum bearing size for the compression rollers in the press section shall be 85mm in diameter. The ends of each shaft on the rollers shall be equipped with support bearings as specified under bearings.
7. The pressure section shall have a minimum area of 120 ft². This calculation shall be based on one belt in contact with the roll surface.
8. The vertical pressure zone configuration shall include a tray beneath each roll such that the filtrate is removed from the sludge cake without rewetting of the downstream cake. Each drip pan shall be directed to a final collection pan and piped to the sump area. The collection pans shall eliminate filtrate from landing on the returning belt.

F. Dewatering Belts

1. Belts shall be seamed and fabricated of monofilament polyester, wear resistant plastic material or combination monofilament polyester and stainless steel material. The mesh design shall be selected for optimum dewatering of the sludge with a minimum blinding of the filter fabric.
2. Belt selection shall be based on the manufacturer's experience obtained at other installations dewatering similar sludge's with similar polyelectrolyte conditioning chemicals.
3. The belts shall be warranted for a minimum 2,000 hours of operation. Any belt that fails before that time, provided that the belt press has been operated per the instructions in the operation and maintenance manual, shall be replaced on a pro rata basis.
4. Each belt and connecting splice shall be designed for a minimum tensile strength equal to five times the normal maximum dynamic tension to which the belt shall be subjected. The splice shall be designed to fail before the belt.
5. Belts shall be designed for ease of replacement to minimize belt press downtime. Belt replacement shall be such that disassembly of the unit is not required.

G. Belt Wash System

1. Each filter belt shall be equipped with a belt wash station. The belt wash system shall use high-pressure water spray nozzles equipped with manually operated wire brushes for internal nozzle cleaning. The spray assembly shall be housed in an enclosure in a manner that limits the spray pattern within the housing assembly. The housing enclosure and nozzle assembly shall be readily removable and shall be fabricated from type 304L stainless steel.
2. Each shower box shall include two self cleaning, adjustable angle shower bars to allow for washing of each side of the belt.
3. The housing shall be sealed against the belt with rubber seals. The belt shall be protected from excessive wear by the edges of the wash station housing by replaceable guide surfaces. The belt wash station shall extend over the full width of the filter belt by a minimum of 2 inches.
4. The shower box shall be designed with adjustable upper seals to maintain contact with the belt as the seals wear. The bottom seals shall be attached to sliding panels, adjustable with four bolts in slotted openings in order to maintain seal contact with the belt as the seals wear. The pans for the

shower boxes shall direct the washwater into the filtrate pans for self-cleaning of the belt press. The pans will also be capable of separating washwater from filtrate to keep the two process streams independent.

5. The shower system shall include the MNR Quiet Package for all three shower boxes, including a specially designed shower box enclosure and shower pan that completely eliminates all misting and reduces the noise from the shower bar. While operating, the shower box shall have noise ratings of less than 77 dB at 3 feet from the shower box. Wash water demand shall not exceed 120 GPM at 120 psi. The dewatering system manufacturer shall provide a complete pressure boosting system for the press to achieve the required pressure. The wash water and pressure boosting system shall be designed by the dewatering system manufacturer based on the system requirements.
6. The booster pump shall be a centrifugal type pump with replaceable stainless steel shaft sleeve and casing wear ring. The impeller shall be equipped with a high pressure O-ring seal. The motor shall be a standard NEMA frame, C Face mounting with JM shaft, maximum of 15 HP, 3500 RPM, 480 volt, 60 hertz, 3-phase power, with a TEFC enclosure. The belt press manufacturer shall supply a 4-1/2 inch pressure gauge with isolation diaphragm with a scale of 0 to 200 PSI. The wash water booster pump shall be a Goulds model 3656 or equal. The shower system shall include a dual basket Titian strainer.
7. All piping from the booster pump shall be Schedule 80 PVC pipe.

H. Belt Alignment System

1. The belt aligning devices shall be hydraulically operated to align each belt and locate it centrally on the rollers by means of a sensing arm. Pneumatic systems shall not be permitted. This arm shall operate a pilot valve, which shall modify the position of the hydraulic actuator. The actuator shall be connected to a pivot belt-aligning roller, causing this roller to skew from its traverse position.
2. The alignment system shall function as a continuous automatic belt guidance system and shall be an integral part of the press. The alignment system shall operate with smooth and slow motions resulting in a minimum of belt travel from side to side. The use of electric servos shall not be permitted.
3. Backup limit switches for the belt aligning system shall be provided with sufficient contacts to de-energize all drives and sound an alarm in case of a belt over travel.
4. A complete simplex hydraulic system shall be provided. This system shall include pump, 2 HP TEFC motor, valves, 20-gallon 304 stainless steel storage reservoir, all controls and piping as necessary to provide a complete and functional system. The pump shall be an adjustable flow and pressure vane pump. The unit shall include a low-pressure switch, system pressure gauge, temperature gauge, and tank level gauge. The system shall include a high-pressure line filter and low-pressure return filter. The hydraulic unit shall be floor mounted away from the press to eliminate wash down spray. A minimum of 1/2" 316L stainless steel tubing shall be provided from the hydraulic unit to the press.
5. The hydraulic unit shall be supplied with a 304L stainless steel support stand to allow for the tank oil to be easily drained. The tank shall also include a 316L stainless steel drain valve to allow for draining of the hydraulic oil.
6. All hydraulic lines and fittings shall be 316L stainless steel and rigidly supported on the structural frame and properly sized for the intended use with adequate factors of safety for the rated pressure.
7. All belt alignment control equipment shall be fabricated from aluminum or stainless steel. The

hydraulic cylinders shall be composite material with stainless steel rods and hardware.

I. Belt Tensioning System

1. Each belt shall be provided with a belt tensioning system. The belt tensioning system shall be hydraulically actuated and shall be such that the dewatering pressure is directly proportional to belt tension and that adjustments in the tension shall result in immediate changes in dewatering pressure. Manual or electric servo tensioning systems are shall not be permitted.
2. Each belt tensioning system shall be furnished with an individual control station such that independent adjustment for each belt is possible. The control stations shall incorporate an on/off selector, calibrated pressure regulating valve and a pressure gauge to indicate actual operating pressure on each system.
3. The tension arms in the pressure section shall be automatically monitored. The smart tensioning monitoring system shall allow the operator to be notified when belt looping starts. If looping becomes excessive it shall be capable of automatic shut down to protect the belts from damage. The smart monitoring system shall also alarm on belt breakage and loss of belt tension.
4. The design of the belt tensioning system for the pressure section shall insure parallel movement of the cylinders on each end of the tensioning roller by use of a rack and pinion assembly. The gravity belt tensioning roller shall be mounted on a rugged yoke assembly, with hydraulic cylinders at each end. Plastic components will not be accepted. The belt tensioning system shall accommodate a minimum of 2.5% increase in belt length. The system must be capable of producing up to 70 PLI belt tension at a system pressure of 1,000 PSI or less.
5. Sensing devices shall be furnished to determine belt travel beyond normal operating limits. The sensing devices shall be electrically connected within the alarm system to cause "an alarm shut down". Manual reset of the system shall be required.
6. The hydraulic cylinders shall be composite cylinders with stainless steel hardware. The cylinder rods shall be constructed with 316 stainless steel.

J. Press Drives

1. The three belt drives shall be 3 HP gravity drive and dual 3 HP press section drive. Each shall be variable speed with a variable frequency AC drive unit. The feedbox paddle wheel shall be driven by 1/3 HP AC/VFD drive. Speed indicator readout for each shall be installed in the main press control panel. All motors shall be TEFC.
2. The gravity belt drive shall be capable of varying output speed from 8 to 75 feet per minute and the press section drive, 3 to 15 feet per minute.
3. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Each drive unit shall be rated IP65 and designed for 24-hour continuous service.
4. Each gear reducer shall be totally enclosed, water spray proof, oil lubricated with anti-friction bearings throughout.
5. The drives shall operate on 480 volt, 60 hertz, 3-phase power supply.
6. The belt drive for the pressure section shall be driven by dual drive rollers. Each gearbox shall be shaft mounted. Spur gears or chain driven rollers shall not be permitted.

K. Safety Guards

1. All equipment having exposed moving parts such as fans, V-belts, gears, couplings, chains, and including the pressure roll section, shall be provided with safety guards as required by State,

Local and OSHA standards. All safety guards shall be of a minimum Type 304 stainless steel construction or better.

L. Discharge Blades

1. Discharge blades shall be provided to scrape dewatered sludge from the belt at the final discharge rollers. The doctor blade shall be made of wear resistant UHMW plastic mounted to a 304 stainless steel support bar. The blades shall be readily removable. The blade holders shall be secured in place by means of counterweights. Spring tension type fasteners shall not be permitted.
2. The minimum discharge height shall be 6'6" high. If necessary, the belt presses and catwalks shall be supplied with additional support legs by the press manufacturer.
3. If the press is elevated in order to discharge into the existing conveyor, the manufacturer shall supply operator platforms down both sides of the press.
4. The manufacturer shall supply a 304 stainless steel discharge hopper that will be mounted off the press frame and will chute sludge into the existing discharge conveyor. The hopper shall be a minimum thickness of 12 gauge, 304 L stainless steel.

M. Bearings

1. The shafts of all rollers shall be equipped with heavy-duty grease-able type, roller bearings in sealed, split case bearing housings. All bearings in the press shall be spherical roller bearings. The housings shall allow the changing of the bearings without changes in the factory alignment of the roller. The split case housing shall be sealed to provide adequate sealing from moisture and grime with closed end housing. The outside of the housing on tracking roller bearings shall also incorporate a stainless steel sealed end cap.
2. The bearing housing seal shall incorporate a triple lip, nitrile seal mechanism to eliminate contamination. Dual lip seals will not be accepted.
3. All bearings shall have a minimum B 10 bearing life of 1,000,000 hours based on ANSI B13.6 1972. The B 10 bearing life of 1,000,000 hours shall be based on the maximum summation of all forces applied to the bearing. The forces shall include both belts at a belt tension of 70 PLI each, maximum belt speed of 15 ft/min and torque of the drive motor.
4. Bearings and housings shall be US manufactured and shall be manufactured by FMC Corporation, Link-Belt Division, Indianapolis, Indiana; Reliance Electric Company, Dodge Division, Greenville, South Carolina; or equal.
5. All bearings shall be manufactured and supplied with off the shelf bearings and housings from the above manufacturers with original part numbers. Any manufacturers that supply only their belt press manufacturer part number, provide custom bearing manufacturing, or manufacture the bearing housing will not be considered.

N. Rollers

1. All rollers shall be of solid steel or double-separated plate stub end shaft construction. The stub end shafts and roller heads shall be welded in place. Bolted and or through shaft roll construction shall not be permitted. All rollers shall be designed to have a maximum deflection of 0.05 inches at their center when under maximum loading (280 PLI at 15 ft/min).
2. All rollers except drive and tracking rolls shall be of carbon steel construction, coated with a minimum of 30 mils of thermoplastic nylon, selected by the press manufacturer. Drive and tracking shall incorporate 50 mils of thermoplastic nylon with a 65 Durometer surface or 3/8" vulcanized rubber for abrasion resistance and proper belt tracking and drive. Other types of roller

coatings shall not be permitted.

3. All rollers must be US manufactured at the suppliers manufacturing facility. Out sourced roll suppliers will not be accepted.

O. Drainage Pans

1. Drainage pans shall be supplied as necessary to contain all filtrate and wash water within the belt filter press and to reduce rewetting of downstream cake. Filtrate and wash water pans shall be constructed of minimum 14-gauge type 316L stainless steel. All drainage piping shall schedule 80 PVC, adequately sized for the intended service and rigidly attached to the press frame.

2.4 ELECTRICAL REQUIREMENTS

A. General Requirements

1. Provide belt press control panel constructed of 304 stainless steel, NEMA 4X construction.
2. The Control Panel shall include a PLC based control of all system components including each press, the hydraulic units, wash water booster pumps, polymer make-down unit, polymer aging tanks mixers, polymer feed pump, sludge feed pump, feed box motor drive, gravity section drive, and pressure section drive. The control panel shall include the VFDs for the polymer feed pump, feedbox, gravity section drive and pressure section drives. The sludge pump VFDs shall be NEMA 4X and externally mounted to the exterior of the master control panel. The control panel shall include the starter for the polymer aging tank mixer. The control panel shall include motor starters for the hydraulic unit and wash water booster pump.
3. Three phase, 480 volt, 60-Hertz power shall be supplied to the control panels A control transformer will be provided for 120-volt, single phase power source for motor starter coils, lights, relays, timers, controllers, and other related items.
4. Each control panel shall include an Allen Bradley Compact Logix PLC and a 12" color Panelview Plus 7 OIT. The PLC and OIT programs shall be provided to the owner after start up is completed.
5. Each control panel shall include a Double Door Hoffman enclosure with a properly sized Hoffman air conditioner.
6. Each control panel shall be provided with terminal blocks for power wiring to and from the panel. The incoming terminal blocks shall be provided with a single magnetic circuit breaker disconnect switch. Circuit breaker protected motor starters with thermal overloads shall be supplied for each motor furnished with the unit.
7. All electrical equipment controls located on the belt press shall have NEMA 4X enclosures and wired, through PVC conduit, to a single common NEMA 4X terminal box.
8. All devices within the panel shall be permanently identified. Nameplates shall be provided on the face of the panel or on the individual device as required. Nameplates shall be made of laminated phenolic materials with a white face and a black core.
9. The panel shall be designed for manual starting and stopping of all drives. A master manual/ auto system switch shall be supplied to override the alarm system and allow operation of any drive through a momentary contact pushbutton. The control panel shall contain start/stop pushbuttons, run lights, and alarm indications for the sludge pumps, polymer systems, conveyors and the

booster pumps.

10. The panel shall be equipped with a start/stop switch and run light displayed on the OIT for each adjustable piece of equipment. The belt drives, feedbox drive, conveyor system, booster pump, hydraulic unit, polymer system and sludge pump drives as hereafter specified, shall also incorporate speed control and speed indication. The control panel shall include start/ stop pushbutton, run lights, speed control and 4 to 20 mA signal generators for the polymer solution and sludge pumps controls.
11. Alarm lights, sensors, and related circuitry shall be provided for the following functions: zero speed, emergency stop push button on each side of the press, low water pressure, and low hydraulic pressure. In the event of any of the above malfunctions, the machine will shut down and an alarm sound. The alarm system shall include an audible horn rated at 90 DBA at IO'. The system shall include silencing provisions, but the function alarm indicating light shall remain lit until the alarm condition is satisfied. A separate set of alarm contacts shall be provided for remote alarm indication
12. Additional stations shall be included as hereinafter specified for other ancillary drives or systems.
13. Arrange the control panel to include the following controls for each belt press control panels to allow either manual or automatic control of belt press equipment. When "MANUAL" operation is selected, all equipment associated with the belt press shall be controlled by "START/STOP" pushbuttons. When "AUTOMATIC" operation is selected, control of equipment shall be "AUTOMATIC/START" and "AUTOMATIC/STOP" pushbuttons, and programmable controller:
 - a. Local belt press control panels shall include OIT touchscreens with the following:
 - 1) One control mode selector switch marked "AUTOMATIC/MANUAL." When "MANUAL" operation is selected, all equipment associated with belt press shall be controlled by "START/STOP" pushbuttons. Provide one "START" and one "STOP" pushbutton for each of the following:
 - a) Feedbox Drive.
 - b) GBT Drive.
 - c) Press Press Drive.
 - d) Hydraulic Unit.
 - e) Wash Water Pump.
 - f) Sludge Pump Drive.
 - g) Polymer Pump Drives.
 - h) Discharge Conveyor System
 - 2) One speed potentiometer for manual adjustment of each drive speed.
 - 3) Digital indicators for sludge feed flow rate. Indicators shall accept 4 to 20 mADC field input and shall be calibrated in GPM.
 - 4) Green indicating lights for "RUNNING" status for each unit operated from panel, including wash water solenoid valve energized indication.

- 5) Red indicating lights for “OFF” status for each unit operated from panel, including wash water solenoid valve de-energized indication.
- 6) One each “AUTOMATIC/START” and one “AUTOMATIC/STOP” momentary pushbuttons, for automatically starting and stopping each belt press system. Sludge cake conveyor shall be manually controlled when belt press control mode selector switch is in either the “AUTOMATIC” or “MANUAL” position.
- 7) One “EMERGENCY STOP” red mushroom pushbutton.

14. Automatic Controls and Sequencing:

a. General:

- 1) Program the PLC for automatic control of belt press, system sequencing, and interlock functions as specified.
- 2) Configuration and programming of PLC system shall be responsibility of belt press manufacturer. System documentation including memory loading, I/O configuration and programming shall be provided.
- 3) Provide and install auxiliary relays and wiring for equipment and devices specified in this Section required for implementing functional requirements specified.

b. “AUTOMATIC START/AUTOMATIC STOP” Cycle (typical for all belt presses):

- 1) Automatic start cycle request to PLC shall be initiated by “AUTOMATIC/START” pushbutton.
- 2) Control logic for an “AUTOMATIC/START” cycle shall start belt press in the following order after “AUTOMATIC/START” command has been initiated and interlocks are complete.
 - a) Wash water pump.
 - b) Belt Shower “Pre-Wash”
 - c) Belt press drive.
 - d) GBT drum drive.
 - e) Press drive.
 - f) Polymer solution pump drive.
 - g) Sludge feed pump.
 - h) Discharge Conveyor System.
- 3) In “AUTOMATIC” mode the polymer system will automatically be called to dilute the neat emulsion polymer system. The polymer system will be controlled by the level sensor in the age tank. Each unit will start and stop based on preset levels in the tanks that can be viewed on the OIT.
- 4) Each drive shall not start until previous drive is running and necessary time delay has elapsed. The belt press manufacturer shall determine where time delays are required and shall program settings to provide smooth start-up of equipment.

- 5) Once all drives are confirmed running by motor run contacts from their respective starters, PLC shall cause the run indicating light to illuminate. Loss of run status contact for a drive once cycle logic is complete shall shut down belt press and associated equipment.
 - 6) Upon "AUTOMATIC /STOP" command, system shall shut down in order that is reverse of specified start-up order with necessary time delays.
- c. Interlocks: The following interlocks shall be satisfied when control mode selector switch is in either "AUTOMATIC" or "MANUAL" position. Failure of any one signal during start cycle or after cycle is complete shall shut down all associated belt press equipment.
- 1) Wash water pump must be on and sufficient wash water pressure must be sensed at a specified level.
 - 2) Hydraulic pressure must be sensed at a specified level.
 - 3) Control mode selector switch shall be in "AUTOMATIC" position.
 - 4) "EMERGENCY STOP" pushbutton shall be in operating position.
15. Annunciation and Alarms:
- a. Provide audible alarm and detailed alarm history in belt press control panel for alarming of the following:
 - 1) GBT drive failure.
 - 2) Press drive failure.
 - 3) Feedbox failure.
 - 4) Local emergency stop initiated at either belt filter press control panel or pull cord switch.
 - 5) High discharge pressure at sludge feed pump.
 - 6) Low washwater pressure.
 - 7) Low hydraulic pressure.
 - 8) Polymer pump failure.
 - 9) Sludge pump failure.
 - 10) Conveyor zero speed.
 - 11) Low polymer tank level.
 - b. Wire all alarms to PLC system for relaying to remote location.
16. Additional stations shall be included as hereinafter specified for other ancillary drives or systems.

B. Electric Motors furnished with this equipment shall meet the following requirements:

1. Rated for continuous duty at 40°C ambient and insulated with a minimum of Class F insulation, with Class B temperature rise. All motors shall be totally enclosed, fan cooled or non-ventilated. All motors supplied shall be rated at 150% nameplate horsepower of the required horsepower maximum service condition.

2.5 POLYMER FEED SYSTEM

- A. The press manufacturer shall provide as a part of the total dewatering equipment package, one (1) emulsion polymer make down unit. The press manufacturer shall also supply a polymer system capable of manually diluting, activating and feeding a emulsion polymer with water. Unit shall be a BDP Industries, Inc. or approved equal.
- B. Polymer Make-Down Unit
 - 1. Polymer and water shall be mixed in a chamber designed to create sufficient mixing energy. This design shall include a progressive cavity metering pump, solenoid valve and pressure regulator.
 - 2. The pumps shall have an adjustable speed with a variable frequency drive. The pumps shall be supplied with a 1/2 hp, 120 volt AC motor.
 - 3. A motor driven impeller mixer shall be provided that will mix the polymer and water into solution.
- C. Polymer Feed Pump
 - 1. The polymer system shall be equipped with progressive cavity pump each capable of pumping up to 10 GPH.
 - 2. The pump shall be designed with a high viscosity wet end pump capable of pumping neat polymer solution to the mixing chamber.
 - 3. The pump shall be a Seepex, or approved equal.
 - 4. The drive motor shall be a variable speed, 1/2 horsepower, complete with an SCR control unit. The SCR control unit shall have local speed adjustment, ON-OFF switch and running indication. The control unit shall provide adjustments of feed rate over a range of 20 to 1.
- D. Dilution Capability
 - 1. The primary dilution shall feed into the motorized mixing chamber and shall be capable of 2400 GPH.
 - 2. The dilution capability shall be adjustable with a clear rotameter with a stainless-steel float. Each flow meter shall be independently adjustable.
 - 3. Furnish a solenoid valve or ON-OFF control of dilution water supply.

2.6 FLOW METER

- A. The belt press manufacturer shall supply one (1) totalizing flow meter as supplied by Siemens or approved equal. The flow meter shall include a 4" ANSI flange connection for the sludge feed line and shall have a digital display, and 30 feet of display cord.
- B. The electromagnetic induction flow meter shall generate a voltage linearly proportional to flow for full-scale velocity setting from 2 to 33 feet per second. Standard accuracy of plus output shall be +/- 0.5% of rate for all meters.
- C. The meter shall incorporate a high impedance amplifier of 1012 ohms or greater, eliminating the need for electrode cleaning systems the meter shall utilize bipolar pulsed DC coil excitation with auto-integrated zeroing each half-cycle. Manual zero adjustments shall not be required - even at start-up. Power consumption shall be no more than 15 VA, independent of meter size. Input power required will be from 85 to 120 VAC, 46-65 Hz, with DC input option available.
- D. The power to each flow meter is 120 volt, single phase with a 2 amp breaker fed from the belt press control panel.

- E. The magnetic flow meter shall be microprocessor based with integral electronics. The electronics shall be interchangeable for all sizes from 1/12" to 78". The housing is to be powder coated cast aluminum with a NEMA 4X rating.
- F. The meter's analog and pulse outputs shall be independently selected by push buttons. The analog output shall be an isolated 4-20mA DC into 700 ohms load. The pulse output shall be an open collector output with a maximum frequency of 1,000 Hz with configurable pulse width (0.5 to 2 sec). An open collector status output shall indicate either system or process error or flow direction. An auxiliary input shall be available to positive zero return. A low flow cutoff will be standard which can be turned on or off by pushbuttons.
- G. A 2-line, 16-digit LCD backlit display shall indicate flow rate and/or total flow. The totalizer value is protected by EEPROM during power outages and utilizes an overflow counter. The display shall also be capable of indicating error messages such as empty pipe condition, error condition and low flow cutoff.

2.7 SLUDGE FEED PUMP

- A. The press manufacturer shall provide as a part of his total dewatering equipment package, two progressive cavity pumps for feeding sludge to the belt press. The flow capacity of each pump shall be an adjustable range of 50 to 285 GPM at a differential pressure of 50 PSI when operating at a maximum speed of 300 RPM. The pumps shall be sized to handle a minimum 1-5/8" diameter solid.
- B. Each pump shall be of the positive displacement, progressive cavity type consisting of a helical rotor, elastic stator, flexible joint and shaft assembly, suction and discharge ports, stuffing box with lantern ring, and drive shaft with bearings and housing. The pumps shall be Seepex NS 100-6L or MXQ Model EH-1900 or approved equal and shall be capable of continuous operation without cavitation or pulsation. It shall be capable of pumping without imparting any turbulence or shearing to the sludge being pumped.
 - 1. The helical rotor shall be constructed of hard chrome plated stainless steel. The elastic stator shall be vulcanized Buna-N with a minimum Durometer hardness of 65 molded inside the cast iron housing.
 - 2. A minimum of two (2) cardan type universal joints shall be used to connect the rotor to the drive shaft. Each joint shall have a minimum of two (2) pins per joint and shall be grease lubricated and sealed in a rubber boot for extended life and lower maintenance.
 - 3. Joints shall be connected to the drive shaft and rotor by means of solid tapered pins and sleeves for maximum torque handling capability. The drive shaft shall be supported by both single and double row heavy duty, grease lubricated ball bearings to withstand all axial and radial loads without affecting component life expectancy.
 - 4. Both suction and discharge ports shall be ANSI 125-pound flanges for maximum resistance to pipe bending forces and deflections. The suction flange shall be 5" diameter, and the discharge flange 4". The suction flange shall be rotatable in 90 degree increments to accommodate any piping configuration or later modification.
 - 5. The pump shall be furnished completely assembled and mounted on a fabricated steel base, with drive assembly.

6. The drive shall consist of a Severe Duty rated TEFC 20 HP gear motor, with an output RPM of 300. The motor shall have Class F insulation. Connection between the motor and pump shaft shall be flexible coupled, Falk or equal. Each gear motor shall be driven by a variable frequency drive, located in the main press panel and shall be of equal construction to the press drive. All control shall be from the press panel.

2.8 DISHCARGE CONVEYOR

- A. Dewatered sludge from the belt filter press shall discharge to a U-trough inclined sludge screw conveyors as shown on the contract drawings. The incline conveyor will discharge into one (1) horizontal loadout conveyor as show on the contract drawings. The horizontal loadout conveyor will be equipped with a reversing motor and will be able to covey cake in both directions. The horizontal loadout conveyor will have two openings on both ends of the structure. One opening will be used to fill up the existing dump trailer or roll off container. The other opening will drop into one (1) horizontal drying bed conveyor. The first horizontal drying bed conveyor will have one opening in the center of the middle drying bed and one opening at the end to feed into the second drying bed conveyor that will conveyor to the farthest drying bed.
- B. The conveyor system shall be designed to handle 15% to 20% sludge (dry solids basis) at rates up to 270 cu. ft. per hour. This screw conveyor system shall convey dewatered sludge for direct discharge into the load out container outside the sludge facility as shown on the contract drawings.
 1. Construction of the outside troughs shall be minimum 10 gauge T304SS. End flanges shall be of similar construction with support foot for anchorage. All support members shall be hot dipped galvanized and mounting hardware shall be T304SS. The conveyor mounted off the discharge of the press shall be 12" in diameter with the length of 32 feet. The reversing horizontal conveyor shall be 12" diameter with the length of 18 feet four inches. The first load out conveyor to the drying beds shall be 12" diameter with an overall length of 33 feet 10 inches long. The second load out conveyor to the drying beds shall be 12" diameter with an overall length of 28 feet 10 inches long. Construction of the outside troughs shall be minimum 10 gauge T304SS. End flanges shall be of similar construction with support foot for anchorage. All support members and mounting hardware shall be T304SS.
- C. Construction of the outside troughs shall be minimum 10-gauge T304SS. End flanges shall be of similar construction with support foot for anchorage. All support members shall be 304 stainless steel and mounting hardware shall be T304SS.
- D. The auger shall be minimum 10-gauge T304SS construction with pitches designed to transport the material referenced above. Support for the auger shall be external 4 bolt flanged ball bearing with end plates specifically designed and sealed for this application.
- E. Sludge shall be directed to the conveyor system and splashing prevented through the use of a 14 gauge T304SS hopper and splashguards. Construction shall be welded with interconnections of T304SS hardware.
- F. The drive for the incline, reversing conveyor, and load out conveyor shall consist of a gearbox and 5 HP 3/60/460V, 50 RPM output constant speed drive (TEFC), rated for continuous service. Each drying bed conveyor shall have one 5 HP drive motor. The gearbox shall be directly coupled to the auger shaft with gearbox support part of the conveyor support structure. All motors shall be driven by a motor

starters mounted in the belt press control panel.

- G. The screw conveyor shall be mounted on an incline, as shown the Contract Drawings. The maximum incline of the screw conveyor shall not exceed 28 degrees. The discharge height of the discharge screw shall be 8 feet 8 inches off the sludge handling room floor. The screw assembly shall be supported by outboard flanged, sealed bearings at each end of the screw assembly. Intermediate hanger bearings shall be by Nylatron with 304 stainless steel mounting brackets placed as required by the manufacturer. The hanger bearings shall be grease-able and shall include Lube Site model 560 automatic lubricator.
- H. All necessary support brackets and stands shall be supplied by the press manufacturer as shown in the contract drawings. The floor supported conveyor structure shall include I beam construction and cross bracing as shown in the contract drawings.
- I. Any belt presses that do not meet the required discharge height as shown on the drawings must be supplied with additional support member to elevate the press to the height shown. All elevated presses must be provided with catwalks around the entire press supplied by the belt press manufacturer. The platforms shall be constructed of 304 stainless steel support members and aluminum non-slip grating. The platforms shall be three feet wide and shall meet all OSHA requirements.

2.9 TOOLS AND SPARE PARTS

- A. The following minimum spare parts shall be furnished with the system:
 - 1. Thirteen (13) spare spray nozzles, gaskets and retaining rings.
 - 2. Three (3) tracking paddle wear plates and springs.
 - 3. Two (2) relays of each type and size.
 - 4. One (1) spare zero speed sensor of each type.
 - 5. One (1) complete set of replacement belts including gravity belt, and two pressure belts.
 - 6. One (1) complete set of replacement seals for feedbox, paddle wheel, guide rail seals, and three shower boxes.
- B. Manufacturer shall furnish a list of additional recommended spare parts for an operating period of one year. The list shall describe each part, the quantity recommended, and the unit price of the part.
- C. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the Owner at the conclusion of the Project.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Manufacturer shall deliver unit to site and work with plant personnel to unpack and hook up the four main temporary connections. The manufacturer and owner shall provide inspect of complete system and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable

conditions noted with shipper.

3.2 INSTALLATION

- A. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.
- B. Fasteners at all pipe connections must be tight. Install and secure all service lines (hydraulic lines, water lines, etc.) as required.
- C. Check motor and control data plates for compatibility to site voltage. Install and test the pumps grounds prior to connecting line voltage to station control panel.
- D. Prior to applying electrical power to any motors, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.
- E. Pumps and motors shall be installed in accordance with manufacturer's installation instructions, and in accordance with all OSHA, local, state, and federal codes and regulations.
- F. The manufacturer shall provide the services of a qualified factory representative to advise the installing manufacturers on proper installation, setting, piping, and wiring procedures. This time shall be above and beyond the start-up services described below.

3.3 INSPECTION

- 1. A factory qualified service representative shall be present at initial startup of the system to ensure correct installation and rotation of the unit, supervise a review of the operation and testing of the equipment, and to provide training on operation and maintenance requirements of the equipment. Any deficiencies shall be noted and corrected prior to the commissioning of the system.
- 2. Manufacturer's inspection shall include, but not be limited to, the following parameters as applicable:
 - a. Soundness
 - b. Completeness in all details, as specified,
 - c. Correctness of setting, alignment and relative arrangement of various parts; and
 - d. Adequacy and correctness of sealing and lubricants.

3.4 FIELD QUALITY CONTROL

A. Operational Test

- 1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically,

structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction, in the presence of the Engineer and Operator, the contractor shall operate the system through several pumping cycles and shall observe and record operation of components; check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer's Start-up Services

1. Before the equipment is started, the manufacturer shall make a thorough inspection of the installation to make sure the press has been installed properly and that all equipment relating to it has been installed according to the needs of the press.
2. The manufacturer shall provide ten (10) days of on-site services spread over three (3) trips of a qualified factory representative to place the units in operation. The owner shall assist the manufacturer by starting up and operating all support systems such as water, sludge pumping, polymer mixing and feed, electrical power and instrumentation, and other ancillary equipment as needed. This trip will be separate from training and performance. The services provided by the manufacturer shall be as detailed in the O&M manuals and shall include at a minimum the following:
 - a. Check equipment alignment and assure that there are no unusual internal stresses.
 - b. Calibrate all instrumentation such as hydraulic systems.
 - c. Check hydraulic systems to insure proper operation.
 - d. Check lubrication in all drives.
 - e. Adjust all edge seals, discharge scraper blades, drive chains, etc.
 - f. Adjust spray wash, cloth tension, and belt aligning system.
 - g. Start the drives and assure they are operating properly with no binding and with correct rotation.
 - h. Ensure that all ancillary systems have been properly adjusted, including polymer and sludge feed.
3. Start-up services shall be considered completed when the contractor and manufacturer have demonstrated to the owner that the units are operating without mechanical problems.

C. Training supervision

1. During the start-up procedures, the equipment manufacturer shall provide three separate trips, eight days of on-site training to the owner's employees for proper operation and maintenance of the sludge dewatering equipment.
2. Two (2) emergency service trips with one day of on-site service for each trip.

3.5 TESTING

1. In the presence of the Engineer and the Operator, field testing of all equipment shall be performed to determine that operation is satisfactory and in compliance with the specifications. Testing shall be completed after the installation is complete, the equipment has been operated and all necessary adjustments have been made. Testing shall be completed using waste activated sludge produced

from the thickened sludge holding tank and belt press system is complete.

2. During the field tests, as a minimum, the following items shall be recorded:
 - a. Sludge flow rate (gpm)
 - b. Polymer dosage (act. lb/dry ton)
 - c. Discharge cake solids (%wt)
 - d. Minimum solids capture (%)
3. Testing shall meet performance criteria listed in Section 1.3 of this specification before final acceptance by engineer and owner.
4. A written report shall be supplied to the engineer upon completion. Repeat tests if necessary, to obtain results acceptable to engineer.
5. The manufacturer shall take corrective action to ensure full compliance to meet performance criteria. (See section 1.3)

END OF SECTION 47 76 21