

PROJECT MANUAL
FOR
CITY OF LYNCHBURG

WARDS FERRY RD PUMP STATION RENOVATION

BID : 14-859

City Project #: 13033-W

JULY 2013



**PROCUREMENT DIVISION
3RD FLOOR CITY HALL
900 CHURCH STREET
LYNCHBURG, VA 24504
TELEPHONE (434) 455-3970
FAX (434) 845-0711**

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ADVERTISEMENT FOR BIDS

Sealed bids for the **Wards Ferry Road Pump Station Renovation**, will be received by the City of Lynchburg, Procurement Division, City Hall, Lynchburg, VA, until **3:00p.m., August 14, 2013**, and then publicly opened and read in the Bidder's Room, Third Floor, City Hall.

This project consists of replacing the existing pumps and piping, electrical system and making minor building repairs. New items will include a diesel generator and fuel tank and instrumentation and controls.

The Project Manual and Drawings for this project may be viewed and downloaded from the City's website: <http://www.lynchburgva.gov/current-solicitations>

An Optional pre-bid conference will be held at 10:00 a.m. on July 24, 2013 at the Wards Ferry Road Pump Station at the intersection of Wards Ferry Road and Heritage Drive, Lynchburg, VA 24504. Parking for the meeting is not available on the street or site. Bidders are requested to park nearby in the Heritage High School parking lot.

Contact Lisa Moss at (434) 455-4228; fax: (434) 845-0711; email: lisa.moss@lynchburgva.gov for further information. All requests for clarification or questions regarding this bid must be received no later than 9:00 a.m. on August 6, 2013.

BID FORM

Lisa Moss Procurement Division
City of Lynchburg
Third Floor, City Hall
900 Church Street
Lynchburg, Virginia 24504

Dear Ms. Moss:

The undersigned, as bidder, hereby declares that the only persons interested in this bid as principal, or principals, is or are named herein and that no person other than herein mentioned has any interest in this bid or in the Construction Agreement to be entered into; that this bid is made without connection with any other person, company, or parties making a bid; and that it is in all respects fair and in good faith, without collusion or fraud.

The undersigned, having visited and examined the site and having carefully studied all the Contract Documents, including without limitation, all drawings and specifications pertaining to "**Wards Ferry Road Pump Station Renovations**" for the City of Lynchburg, Virginia, hereby proposes to furnish all labor, equipment, materials, and services and to perform all operations necessary to execute and complete the Work required for the project, in strict accordance with the Contract Documents and the Project Manual together with Addenda numbered _____ through _____ issued during bidding period and hereby acknowledged, subject to the terms and conditions of the Construction Agreement for the lump sum amount of:

TOTAL BASE BID: _____ Dollars

(\$ _____) which shall be referred to hereinafter as the Base Bid.

Determination of the low bidder shall be based on the Base Bid without consideration of any equal products.

Request for approval of equal products shall be submitted and evaluated according to the requirements of the Instructions to Bidders and the General Conditions.

PROPOSED EQUAL PRODUCTS		
Equipment Specification Number and Named Manufacturer	Manufacturer's Name and Nomenclature of Proposed Equal Product	Amount of Deduct from the Base Bid
111300 Horizontal Split Case Pumps, Fairbanks-Morse		
111300 Pump Control Valve, Cla-Val		

It is understood and agreed that the Owner, in protecting its best interests, reserves the right to reject any or all bids or waive any defects. Any changes, erasures, modifications, deletions in the bid form, or alternate proposals not specified in the Advertisement for Bids may make the bid irregular and subject to rejection.

The listed bid items are to contain all necessary costs required for completion of the Work in accordance with the Contract Documents.

If the Construction Agreement is for unit prices and not for a lump sum price, it is understood that all quantities listed on the following pages are estimated quantities, and the Owner reserves the right to raise, lower, or eliminate any quantity or item, and in any case, the unit prices shall be used in determining partial and final payment. It is further understood that costs to cover all components of the Work as described in the Contract Documents are included in this bid, even in cases where specific line items are not identified.

We are properly equipped to execute all work of the character and extent required by the Contract Documents, and we will enter into the Construction Agreement for the execution and completion of the Work in accordance with the Contract Documents; and we further agree that, if awarded the Construction Agreement, we will commence the Work on the date stated in the "Notice to Proceed" and will maintain a work force large enough to execute the Work and all obligations no later than the completion date stated in the Contract Documents.

Enclosed herewith is the following Security, offered as assurance that the undersigned will enter into the Construction Agreement for the execution and completion of the Work in accordance with the Contract Documents:

Bidder's Certified Check issued by _____ (name of bank) in the amount of:

\$ _____ (5% of Base Bid amount)

Bidder's Bid Bond for 5% of Base Bid Amount Issued by _____
(name of surety authorized to do business in Virginia).

The undersigned hereby agrees, if awarded the Construction Agreement, to execute and deliver to the City within ten (10) days after his receipt of the Notice of Award, a performance bond and a payment bond, in forms satisfactory to the City, from sureties authorized to do business in Virginia satisfactory to the City, in the amount of one hundred (100) percent of the Base Bid.

The undersigned further agrees that, in case of failure on his part to execute the said Construction Agreement within the ten (10) days after written notice being given on the award of the Construction Agreement or the failure to deliver the required performance and payment bonds within the ten (10) days, the monies payable by the Security accompanying this bid shall be paid to the City of Lynchburg, Virginia, as liquidated damages for such failure; otherwise the Security accompanying this Bid shall be returned to the undersigned.

Attached herewith are completed Statement of Experience and Statement of Resources forms which include the information requested.

The undersigned further certifies that this bid is not the result of, or affected by, any act of collusion with another person engaged in the same line of business, or any act punishable under the Virginia Governmental Frauds Act, or other law.

This bid remains valid and may not be withdrawn for a period of 60 days from this date.

CURRENT VIRGINIA CLASS A CONTRACTOR'S LICENSE/ REGISTRATION NO.: _____

Respectfully submitted,

CONTRACTOR

DATE

ADDRESS

BY: _____

ITS:
(Title)

ELECTION OF ESCROW ACCOUNT PROCEDURE FOR RETAINAGE

If determined to be the successful low bidder(s), the above signed elects to use the Escrow Account Procedure for retainage.

Write "Yes" or "No" on above line

If the successful bidder elects to use the Escrow Account Procedure for Retainage, the "Escrow Agreement" form shall be executed and submitted to the City of Lynchburg Engineering Division within fifteen (15) calendar days after notification. If the "Escrow Agreement" form is not submitted within the fifteen (15) day period, the Contractor shall forfeit his rights to the use of the Escrow Account Procedure.

Company_____

Authorized Signature_____

EQUAL OPPORTUNITY REPORT STATEMENT

The Bidder shall complete the following statement by checking the appropriate blank as follows.

The Bidder has _____ has not _____ participated in a previous contract subject to the nondiscrimination clause prescribed by Executive Order 10925, dated March 6, 1961, or Executive Order 11114 dated June 22, 1963.

In conjunction with the City of Lynchburg's policy to utilize Minority and Disadvantaged Business Enterprises ("DBE") wherever possible, the Bidder has solicited quotations for labor, material and/or services from the following Minority and Disadvantaged Business Enterprises:

NAME OF FIRM	PERSON(S) CONTACTED	DATE

Of those listed above, we intend, at this time, to utilize the following in the completion of the Work required by this Construction Agreement:

"This firm assures that it will give its best efforts to utilize Minority and Disadvantaged Business Enterprises whenever possible."

CERTIFIED BY: _____(Signature)
_____ (Typed/Printed name & Title)

BIDDER'S NAME: _____

TAXPAYER IDENTIFICATION NUMBER: _____

_____ This firm will perform all construction with its own employees and, therefore, is not required to solicit quotations from DBEs.

FAILURE TO DOCUMENT AND REPORT DBE CONTACTS ON THIS FORM MAY BE A BASIS FOR REJECTION OF THE BID AS NONCONFORMING.

STATEMENT OF EXPERIENCE

Proposer: _____

How Long In Business: _____ At Current Address: _____

Principals: _____ Title: _____
_____ Title: _____
_____ Title: _____

Type of Work Normally Performed: _____

Projects of this type previously completed:

1. _____
_____ Amount \$ _____
2. _____
_____ Amount \$ _____
3. _____
_____ Amount \$ _____

Reference (for Projects listed above):

1. _____
_____ Tel.No. _____
2. _____
_____ Tel.No. _____
3. _____
_____ Tel No. _____

STATEMENT OF AVAILABLE RESOURCES

Equipment: _____

Number of Personnel Currently Employed: _____

Number of Personnel Available for Project: _____

Other Pertinent Information: _____

CORPORATE STATUS FORM

ALL PROSPECTIVE FIRMS MUST RESPOND TO THE FOLLOWING

If a limited liability company, limited liability partnership or a limited partnership, indicate by checking one: _____ Limited liability company

_____ Limited liability partnership

_____ Limited partnership

Have you registered with the Virginia State Corporation Commission, to conduct business in Virginia?

Yes No

Name and address of organizer: _____

List who is authorized to execute contracts:

If conducting business under an assumed (fictitious) business name, fill out the following information:

Names of persons or entities owning business using assumed business name: _____

Owners' addresses: _____

Registration date: _____ Expires: _____

If conducting business as a sole proprietorship, general partnership, or joint venture, fill out the following information:

Names of all persons liable for obligations of the business: _____

Addresses of such persons: _____

Questions to Bidders/Offerors

Bidders/Offerors are to respond to the following question: Have any of the individual(s), owner(s), and/or principal officer(s) of the firm submitting the bid/proposal ever been convicted of (1) a felony, or (2) a misdemeanor involving moral turpitude?

YES _____

NO _____

If yes, list individual or officer and title and give details.

NOTE: Answering yes to this question will not necessarily exclude your company from consideration but will be used to weigh the relationship between the offense and the contract to be performed.

Is your firm currently involved in litigation or a dispute involving arbitration?

YES _____

NO _____

If yes, for litigation list the litigation by case name, name of court, case number, and jurisdiction, and for arbitration, list the organization administering, if any, its contact information, any case number assigned, the arbitrators, and the location of the arbitration. For litigation and arbitration, briefly describe the claims and status, and give contact information for the opposing party or parties.

CONSTRUCTION AGREEMENT

This Construction Agreement (the "Contract") made and entered into on the ____ day of _____, 2013, by and between _____, party of the first part, hereinafter referred to as Contractor, and the City of Lynchburg, a municipal corporation of the Commonwealth of Virginia, party of the second part, hereinafter referred to as the Owner or City.

That the Contractor, for the consideration hereinafter fully set out, hereby agrees with the Owner as follows:

1. That the Contractor shall furnish all labor, materials, tools, and equipment and perform all Work required by the Contract Documents (as defined in the General Conditions hereto) for the Wards Ferry Road Pump Station Renovations

2. That the Contractor shall commence Work within ten (10) days after Notice to Contractor to Proceed with the Work under Contract ("Notice to Proceed"), and shall substantially complete the project within **150 calendar days**. Owner and Contractor recognize that time is of the essence of this Contract and that the Owner will suffer financial loss if the Work is not completed within the times specified in the Notice to Proceed, plus any extensions thereof. They also recognize the delays, expense and difficulties involved in providing 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 certain losses Owner is expected to suffer due to delay (but not as a penalty) **Contractor shall pay \$250.00 for each day that expires after the time specified for completion**. If the Contractor is subject to liquidated damages, the City has the right, but not the obligation, to withhold the liquidated damages from the Contractor's regular payments or retainage. Rights and obligations relating to these liquidated damages are set out more fully in the General Conditions.

3. The Owner hereby agrees to pay the Contractor for the faithful performance of this Contract in accordance with the Contract Documents, subject to additions and deductions as provided in the Contract Documents, in lawful money of the United States, as follows:

_____Dollars
(\$ _____)

4. The Owner shall make partial payment on a monthly basis to the Contractor in accordance with the Contract Documents on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the Contractor, less five percent (5%) of the amount of such estimate which may be retained by the Owner until all Work has been performed strictly in accordance with the Contract Documents and until such Work has been accepted by the Owner.

5. Within ninety (90) days after submission by the Contractor of evidence satisfactory to the Owner that all payrolls, material bills and other costs incurred by the Contractor in connection with the construction of the Work have been paid in full, satisfaction of all the requirements of the Contract Documents, and acceptance of such Work by the Owner, final payment on account of this Contract shall be made.

6. It is further mutually agreed between the parties hereto that if, at any time after the execution of this Contract, the performance bond provided for its faithful performance and the payment bond, the Owner shall deem the surety or sureties upon such bonds or either of them to be unsatisfactory, or if for any reason, such bonds cease to be adequate to cover the performance of the Work, the Contractor shall,

at his own sole expense, within five (5) days after the receipt of Notice from the Owner so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Owner. In such event, no further payment to the Contractor shall be deemed to be due under this Contract until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the Owner.

7. Contractor agrees to fulfill all requirements of state, Federal, and municipal laws which may be applicable to this project.

8. This Contract is subject to the General Conditions accompanying it, and all the documents defined by the General Conditions to be the Contract Documents are a part of this Contract.

This Contract is executed in two counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original contract.

IN WITNESS WHEREOF, _____ has caused its name to be subscribed to this Contract by _____, its _____, and its corporate seal to be hereunto affixed and attested by _____, its _____, said officers being duly authorized therefore; and the City of Lynchburg has caused its name to be hereunto subscribed by L. Kimball Payne, City Manager, and its corporate seal to be hereunto affixed and attested by Valeria Chambers, its Clerk of Council, said officers being duly authorized therefore, all as to the day and year first above written.

CONTRACTOR

BY: _____

ITS: _____

(SEAL)

ATTEST:

CITY OF LYNCHBURG

BY: _____
City Manager

(SEAL)

ATTEST:

Clerk of Council

**CITY OF LYNCHBURG, VIRGINIA
STANDARD PERFORMANCE BOND**

KNOW ALL MEN BY THESE PRESENTS: That _____,
_____, the Contractor ("Principal"), whose principal place
of business is located at _____
_____ and _____
_____ ("Surety"), are held and firmly bound unto the City of Lynchburg, Virginia,
the Owner ("Obligee"), in the amount of _____
_____ Dollars
(\$ _____) for the payment whereof Principal and Surety bind themselves, their heirs, executors,
administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has, entered into a Construction Agreement with Obligee for certain work on a construction project known as **Wards Ferry Road Pump Station Renovations**, which contract (the "Contract") is by reference expressly made a part hereof;

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly and faithfully perform said Contract in strict conformity with the plans, specifications and conditions of the Contract and its Contract Documents, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Provided, that any alterations which may be made in the terms of the Contract, or in the Work to be done under it, or the giving by the Obligee of any extension of time for the performance of the Contract, or any other alterations, extensions or forbearance on the part of either or both of the Obligee or the Principal to the other shall not in any way release the Principal and the Surety, or either of them, their heirs, executors, administrators, successors or assigns, from their liability hereunder, notice to the Surety of any such alterations, extensions, or forbearance being hereby waived.

No action shall be brought on this bond unless brought within one year after: (a) completion of the Contract and all Work thereunder, including expiration of all warranties and guarantees, or (b) discovery of the defect or breach of warranty or guarantee if the action be for such.

The Surety represents to the Principal and to the Obligee that it is legally authorized to do business in the Commonwealth of Virginia.

Signed and sealed this _____ day of _____, 2013.

(SEAL)

Contractor/Principal

By: _____

Witness: _____

Title: _____

(SEAL)

Surety

By: _____

Attorney -in-Fact

My Power of Attorney is recorded in the Clerks Office of the Circuit Court of _____, Virginia in Deed Book _____, Page _____, and has not been revoked.

Attorney-in-Fact

AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT

COMMONWEALTH OF VIRGINIA

(or, alternatively, Commonwealth or State of _____)

CITY/COUNTY OF _____ to wit:

I, the undersigned notary public, do certify that _____ personally appeared before me in the jurisdiction aforesaid and made oath that he is the attorney-in-fact of _____, the Surety, that he is duly authorized to execute on its behalf the aforesaid Bond(s) as its act and deed.

Given under my hand this _____ day of _____ 2013.

(SEAL)

Notary Public

My Commission expires: _____

APPROVED:

City Attorney/Designee

Date

**CITY OF LYNCHBURG
STANDARD LABOR AND MATERIAL PAYMENT BOND**

KNOW ALL MEN BY THESE PRESENTS: That _____
_____, the Contractor ("Principal") whose principal
place of business is located at _____
_____ and _____
_____ ("Surety") are held and firmly bound unto the City of Lynchburg,
Virginia, the Owner ("Obligee") in the amount of _____ Dollars
(\$ _____) for the payment whereof Principal and Surety bind themselves, their heirs,
executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has by written agreement dated _____ entered into a Construction Agreement
with Obligee for Wards Ferry Road Pump Station Renovations.

which contract (the "Contract") is by reference expressly made a part hereof;

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly make payment to all claimants as hereinafter defined, for labor performed and material furnished in the prosecution of the Work provided for in the Contract and its Contract Documents, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions.

The Principal and Surety, jointly and severally, hereby agree with Obligee as follows:

1. A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both for use in the performance of the Contract. A "subcontractor" of the Principal, for the purposes of this bond only, includes not only those subcontractors having a direct contractual relationship with the Principal but also any other contractor who undertakes to participate in the Work which the Principal is to perform under the aforesaid Contract, whether there are one or more intervening subcontractors contractually positioned between it and the Principal (for example, a subcontractor). "Labor" and "material" shall include, but not be limited to, public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the Work site.
2. Subject to the provisions of paragraph 3, any claimant who has performed labor or furnished material in accordance with the Contract Documents in the prosecution of the Work provided in the Contract, who has not been paid in full therefore before the expiration of ninety (90) days after the day on which such claimant performed the last of such labor or furnished the last of such materials for which he claims payment, may bring an action on this bond to recover any amount

due him for such labor or material, and may prosecute such action to final judgment and have execution on the judgment. The Obligee need not be a party to such action and shall not be liable for the payment of any costs, fees or expenses of any such suit.

3. Any claimant who has a direct contractual relationship with any subcontractor of the Principal from whom the Principal has not required a subcontractor payment bond, but who has no contractual relationship, express or implied, with the Principal, may bring an action on this bond only if he has given written notice to the Principal within one hundred eighty (180) days from the day on which the claimant performed the last of the labor or furnished the last of the materials for which he claims payment, stating with substantial accuracy the amount claimed and the name of the person for whom the Work was performed or to whom the material was furnished. Notice to the Principal shall be served by registered or certified mail, postage prepaid, in an envelope addressed to the Principal at any place where his office is regularly maintained for the transaction of business. Claims for sums withheld as retainages with respect to labor performed or materials furnished shall not be subject to the time limitations stated in this paragraph 3.
4. No suit or action shall be commenced hereunder by any claimant.
 - a. Unless brought within one year after the day on which the person bringing such action last performed labor or last furnished or supplied materials, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, the limitation embodied within this bond shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.
 - b. Other than in a Virginia court of competent jurisdiction, with venue as provided by statute, or in the United States District Court for the district in which the project, or any part thereof is situated.
5. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder.
6. This bond is intended to comply with the requirements and to afford all the benefits of a payment bond consistent with the requirements of Virginia Code § 2-2-4337 and § 2-2-4341. To the extent that those sections as they are in effect as of the date of issuance of this bond confer any requirements on Principal or Surety, or confer any additional benefits on any claimant (as the term "claimant" is used within either the meaning of those sections or this bond), those requirements and benefits shall be deemed to be incorporated into and be part of this bond.

Signed and sealed this _____ day of _____.

(SEAL)

Contractor/ Principal

By: _____

Witness: _____

Title: _____

(SEAL)

Surety

By: _____

Attorney-in-Fact

Typed Name: _____

My Power of Attorney is recorded in the Clerks Office of the Circuit Court of _____ Virginia in Deed Book _____, Page _____, and has not been revoked.

Attorney-in-Fact

AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT

COMMONWEALTH OF VIRGINIA

(or, alternatively, Commonwealth or State of _____)

CITY / COUNTY OF _____

I, the undersigned notary public, do certify that _____ personally appeared before me in the jurisdiction aforesaid and made oath that he is the attorney-in-fact of _____, the Surety, that he is duly authorized to execute on its behalf the foregoing bond pursuant to the Power of Attorney noted above, and on behalf of said Surety, acknowledged the aforesaid bond(s) as its act and deed.

Given under my hand this _____ day of _____.

(SEAL)

Notary Public

My Commission expires: _____

APPROVED:

City Attorney/Designee Date

ESCROW AGREEMENT

THIS AGREEMENT ("Agreement"), made and entered into this ____ day of _____, 2013 by,
between and among the City of Lynchburg ("City"), _____ ("Contractor"), and

(Name of Bank)

(Address of Bank)

a trust company, bank, or savings and loan institution with its principal office located in the Commonwealth of Virginia (hereinafter referred to as "Bank" or "Escrow Agent"), and

("Surety") provides:

I.

The City and the Contractor have entered into the Construction Agreement ("Contract") with respect to City Project No. and Name: Wards Ferry Road Pump Station Renovations ("the Contract"). This Agreement is pursuant to, but in no way amends or modifies, the Contract. Payments made hereunder or the release of funds from escrow shall not be deemed approval or acceptance by the City of performance by the Contractor or Surety.

II.

In order to assure full and satisfactory performance by the Contractor of its obligations under the Contract, the City may, pursuant to the Contract Documents, retain certain amounts otherwise due the Contractor. The Contractor has, with the approval of the City, elected to have these retained amounts held in escrow by the Bank. This Agreement sets forth the terms of the escrow. The Bank shall not be deemed a party to, bound by, or required to inquire into the terms of, the Contract or any other instrument or agreement between the City and the Contractor.

III.

The City may from time to time pursuant to this Agreement pay to the Bank amounts retained by the City under the Contract. Except as to amounts actually withdrawn from escrow by the City, the Contractor shall look solely to the Bank for payment of funds retained under the Contract and paid by the City to the Bank.

The risk of loss by diminution of the principal of any funds invested under the terms of this Agreement shall be solely upon the Contractor.

Funds and securities held by the Bank pursuant to this Agreement shall not be subject to levy, garnishment, attachment, lien, or other process whatsoever. Contractor agrees not to assign, pledge, discount, sell or otherwise transfer or dispose of his interest in the escrow account or any part thereof, except to the Surety.

IV.

Upon receipt of checks or warrants drawn by the City's Director of Finance and made payable to it as escrow agent, the Bank shall promptly notify the Contractor, negotiate the same and deposit or invest and reinvest the proceeds in "Approved Securities" within the meaning of this Agreement in accordance with the written instruction of the Contractor. In no event shall the Bank invest the escrowed funds in any security that is not an "Approved Security."

V.

The following securities, and none other, are Approved Securities for all purposes of this Agreement:

- (1) United States Treasury Bonds, United States Treasury Notes, United States Treasury Certificates of Indebtedness or United States Treasury Bills,
- (2) Bonds, notes and other evidences of indebtedness unconditionally guaranteed as to the payment of principal and interest by the United States,
- (3) Bonds or notes of the City,
- (4) Bonds of any political subdivision of the City, if such bonds carried, at the time of purchase by the Bank or deposit by the Contractor, a Standard and Poor's or Moody's Investors Service rating of at least "A", and
- (5) Certificates of deposit issued by commercial Banks located within the Commonwealth, including, but not limited to, those insured by the Bank and its affiliates,
- (6) Any bonds, notes, or other evidences of indebtedness listed in Section (1) through (3) may be purchased pursuant to a repurchase agreement with a Bank, within or without the City, having a combined capital, surplus and undivided profit of not less than \$25,000,000 provided the obligation of the Bank to repurchase is within the time limitations established for investments as set forth herein. The repurchase agreement shall be considered a purchase of such securities even if title, and/or possession of such securities is not transferred to the Escrow Agent, so long as the repurchase obligation of the Bank is collateralized by the securities themselves, and the securities have on the date of the repurchase agreement a fair market value equal to at least 100 percent of the amount of the repurchase obligation of the Bank, and the securities are held by a third party, and segregated from other securities owned by the Bank.

No security is an Approved Security hereunder if it matures more than five years after the date of its purchase by the Bank or deposit by the Contractor.

VI.

The Contractor may from time to time withdraw the whole or any portion of the escrowed funds by depositing with the Bank Approved Securities in an amount equal to, or in excess of, the amount so withdrawn. Any securities so deposited or withdrawn shall be valued at such time of deposit or withdrawal at the lower of par or market value, the latter as determined by the Bank. Any securities so deposited shall thereupon become a part of the escrowed fund.

Upon receipt of a direction signed by the City's Director of Public Works or the City Engineer, the Director of Finance or the City Accountant shall authorize the Bank to pay the principal of the fund, or any specified amount thereof, to the account of the City of Lynchburg. Such payment shall be made in cash as soon as is practicable after receipt of the direction.

Upon receipt of a direction signed by the City's Director of Public Works or the City Engineer, the Director of Finance or the City Accountant shall authorize the Bank to pay and deliver the principal of the fund, or any specified amount thereof, to the Contractor, in cash or in kind, as may be specified by the Contractor. Such payment and delivery shall be made as soon as is practicable after receipt of the direction.

VII.

For its services, hereunder the Bank shall be entitled to a reasonable fee in accordance with its published schedule of fees or as may be agreed upon by the Bank and the Contractor. Such fee and any other costs of administration of this Agreement shall be paid from the income earned upon the escrowed fund, and, if such income is not sufficient to pay the same, by the Contractor.

VIII.

The net income earned and received upon the principal of the escrowed fund shall first be paid or applied to pay the Bank's fee and any other costs of administration and such income shall be deemed a part of the principal of the fund. After all of the Bank's fees and other costs of administration have been paid from such income, the net income earned thereafter may then be paid over to Contractor in installments.

IX.

The Surety undertakes no obligation hereby but joins in this Agreement for the sole purpose of acknowledging that its obligations as surety for the Contractor's performance of the Contract are not affected hereby.

WITNESS the following signatures, all as of the day and year first above written.

CITY OF LYNCHBURG

CONTRACTOR: _____

BY: _____
City Manager

BY: _____
Officer, Partner, or Owner (Seal)

SURETY:

By: _____

Its: President (Seal)

ATTEST:

Secretary

By: _____
Attorney-in-Fact

AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT

COMMONWEALTH OF VIRGINIA

(or, alternatively, Commonwealth or State of _____)

CITY / COUNTY OF _____

I, the undersigned notary public, do certify that _____ personally appeared before me in the jurisdiction aforesaid and made oath that he is the attorney-in-fact of _____, the Surety, that he is duly authorized to execute on its behalf the foregoing bond pursuant to the Power of Attorney noted above, and on behalf of said Surety, acknowledged the aforesaid bond(s) as its act and deed.

Given under my hand this _____ day of _____.

Notary Public (SEAL)

My Commission expires: _____

APPROVED:

City Attorney/Designee Date

INSTRUCTIONS TO BIDDERS

DESCRIPTION OF WORK:

The Work included under this Contract shall consist of all labor, materials, equipment, and the performance of all work necessary to complete the project known as "**Wards Ferry Road Pump Station Renovations**," as described in the Contract Documents. This Work shall be performed in accordance with the Contract Documents.

ACCEPTANCE AND GUARANTEE:

At the completion of the project, a final inspection will be made by the Owner's Project Manager. The Contractor will be notified of the remaining work to be performed. When the work is satisfactorily completed, notification will be given that the project has been accepted. The guarantee period will be one (1) year from date of acceptance.

1. General: Subject to Owner's right to waive informalities, to be valid for consideration, bids must be completed and submitted in accordance with these instructions to bidders. All individual bid unit price items must be filled in, regardless of the quantity shown.
2. Plans and Specifications: Bidding documents will be provided as indicated in the Advertisement for Bids.
3. Qualification of Bidders: Each bidder must be prepared to submit within five calendar days of the Owner's request written evidence of his qualifications for the project, including, without limitation, financial data, previous experience, resources, personnel and evidence of authority to conduct business in the jurisdiction where the project is located.
4. Examination of Bid Documents and Site:
 - 4.1 Before submitting bids, each bidder must examine bid documents, including, without limitation, all the Contract Documents, thoroughly; familiarize himself with Federal, state and local laws, ordinances, rules, codes, and regulations affecting the Work; and correlate his observations with requirements of the bid documents.
 - 4.2 Bidders are requested and expected to visit the site of the project to alert themselves to local and special conditions which may be encountered during construction of the project such as: labor and transportation, handling and storage of materials, the availability of materials, and site access. Failure to make such investigations shall not relieve the successful bidder from performing and completing the Work in accordance with the Contract Documents.
 - a. A pre-bid conference will be held at the time and place stated in the Advertisement for Bids.
5. Clarification:
 - 5.1 No oral clarification of the bid documents will be made to any bidder. To be given consideration, requests for clarification must be received in time to allow preparation of a written response at least seven (7) days prior to date fixed for opening of bids. Clarifications will be issued in the form of written addenda to the bid documents and posted to the Procurement Website within five (5) days of the bid opening. Only clarifications by formal written addenda will be binding.
 - (1) All communications in regard to clarifications and any other matters related to this project shall be addressed to: Lisa Moss, Procurement Division, 900 Church Street, Lynchburg, VA 24504, Fax: 434-845-0711, email: lisa.moss@lynchburgva.gov.
6. Substitutions:
 - 6.1 Substitutions of material or equipment or both may be offered by the Contractor with his bid, provided that, if approved:

- a. No major changes in the construction or design intent of the project would be required. Changes required to accommodate substituted items shall be made by the Contractor at no additional cost or time delay.
- b. Features of quality, capacity, construction, performance, appearance, size, arrangement, and general utility, including economy of operation of substitutes offered, either parallel or exceed those of specified products.
- c. The provisions of the General Conditions are met, and the provisions of the General Conditions any other guarantees, if required by the specification sections, shall apply in full force and effect to the performance of such substitute products; approved for incorporation into the Work.

6.2 Technical data covering the proposed substitution shall be furnished with the bid when possible, and not later than 10 days after bid submission.

7. Bid Submission:

7.1 Submit bids using forms furnished in the Project Manual and fill in all blank spaces on the form. Repeat notation "Contractor's Current Virginia License No. _____" on outside of inner envelope containing bid and bid security, and place this envelope within another envelope addressed to:

City of Lynchburg
 Procurement Division
 900 Church Street
 Third Floor, City Hall
 Lynchburg, VA 24504

Bidders shall include the following with their bid submission:

- Bid Form
- Statement of Experience
- Statement of Available Resources
- Equal Opportunity Report Statement
- Corporate Status Form
- Questions to Offeror Form
- Bid Bond or Cashiers Check Equivalent

7.2 Both the inner and outer envelopes shall have noted thereon:

- a. "Sealed Bid #14- 859 Wards Ferry Road Pump Station Renovations
- b. The bidder's name and address; and
- c. City Project #: 13033-W
- d. Repeat notation "Current Registered Virginia Contractor No. ____" on the outside envelope.

7.3 Each bid must be accompanied by a cashier's check payable to the City drawn on a bank satisfactory to the City, or a Bid Bond, in the amount of five percent (5%) of the amount of the total base bid, with the City as obligee, as assurance that the successful bidder will enter into the Contract within ten (10) days after Notice of Award.

If the successful bidder defaults by failure to enter into the Contract and to provide required performance and payment bonds, the certified check or Bid Bond accompanying the successful bid shall be collected by the City, not as a penalty but as liquidated damages for delays and such additional expenses as may be incurred by the City for reasons of such default.

7.4 Contractors will indicate a lump sum bid for on the bid form. The lump sum bid shall contain all necessary costs required for completion of the Work. Any changes, erasures, modifications, or

deletions in the bid form, or alternate proposals not specified in the bid proposal may make the proposal irregular and subject to rejection.

7.5 Receipt deadline for bids will be as stated in the Advertisement for Bids.

7.6 Bids will be opened publicly in accordance with the Advertisement for Bids.

7.7 Withdrawal of bid after bid opening: To withdraw a bid after bid opening, a bidder must satisfy the substantive requirements of Va. Code §2.2-4330. In addition, the following procedures shall apply:

a. The bidder shall give notice in writing of his claim of right to withdraw his bid within two business days after the conclusion of the bid opening procedure and shall submit original work papers with such notice.

b. The mistake may be proved only from the original work papers, documents and materials used in preparation of the bid and delivered as required herein.

8. Bonds and Damages:

8.1 Bonds shall be with a surety company acceptable to the Owner- that is legally authorized to do business in Virginia and in a form acceptable to Owner.

8.2 A performance bond and a labor and material payment bond will be required in the amount of 100 percent of the bid.

8.3 Liquidated damages shall be as indicated in the Contract Documents.

9. Award of Contract:

9.1 The award of the Contract will be the responsible bidder submitting the lowest responsive base bid.

Selection of the apparently successful bidder's responsibility will include a serious evaluation of whether the bidder has conscientiously attempted to meet Minority and Disadvantaged Business Enterprise goals. A requirement of the Contract bidder will be that a genuine concerted effort will be utilized to meet the Contract goal.

9.2 Before the Contract is awarded, the bidder submitting the lowest responsive bid must satisfy the City that it has the requisite organization, capital, equipment, ability, resources, personnel, management, business integrity, and at least five years experience in the type municipal work for which it has submitted a bid. Each bidder shall, with his bid, submit a list of at least five projects of similar size and dollar value completed within the last five years, giving location, dollar value, year completed, and the name(s) of the owner(s) and architect/engineers(s). The bidder shall verify to the City that it has the sufficient and qualified personnel to provide for the Contact Work. Failure by the lowest responsive bidder to sufficiently satisfy the City of its ability to meet any of the above requirements may serve as grounds for rejection of the bid.

9.3 The Owner reserves the right to cancel the Advertisement for Bids, reject any and all bids, waive any and all informalities, and disregard all conforming, nonconforming, conditional bids or counterproposals.

9.4 Unless canceled or rejected, a responsive bid from the lowest responsible bidder shall be accepted as submitted, except that if the responsive bid from the lowest responsible bidder exceeds available funds, pursuant to Section 18.1-9 of the Lynchburg Public Procurement Code, the Owner may negotiate with the apparent low bidder to obtain a contract price within available funds.

- a. Procedures for Negotiations: If the Owner wishes to negotiate with the apparent low bidder to obtain a contract price within available funds, negotiations shall be conducted in accordance with the following procedures:
1. If the using agency wishes to conduct negotiations pursuant to this section, it shall provide the procurement administrator with a written determination that the bid from lowest responsive, responsible bidder exceeds available funds. This determination shall be confirmed in writing by the director of finance or his designee. The using agency shall also provide the procurement administrator with suggested measures to bring the proposed purchase within budget through negotiations with the lowest responsive, responsible bidder, including reductions in scope, changes in quality, value engineering, changes in terms and conditions, or changes in schedule.
 2. The procurement administrator shall advise the lowest responsive, responsible bidder, in writing, that the proposed purchase exceeds available funds. He shall further invite proposed measures, such as a reduction in scope, change in quality, value engineering, changes in terms or conditions, or changes in schedule for the proposed purchase, and invite the lowest responsive, responsible bidder to amend its bid based upon the proposed measures to bring the purchase within available funds.
 3. Informal discussions between the City and the lowest responsive, responsible bidder, either in person, by e-mail, by telephone, or by other means, may be used to attempt to obtain a contract within available funds.
 4. Following any successful negotiations, the lowest responsive, responsible bidder shall submit a proposed addendum to its bid, which addendum shall include the specific changes in the proposed purchase, the reduction in price, and the new contract value. The addendum shall be reviewed by the purchasing agency, the City Manager, and City Attorney for acceptability.
 5. If an addendum is acceptable to the City, the City may award a contract within funds available to the lowest responsive, responsible bidder based upon the amended bid proposal.
 6. If the City and the lowest responsive, responsible bidder cannot negotiate a contract within available funds, all bids shall be rejected.

9.5 Protests of Award or Decisions to Award of Contract

- a. The following are the exclusive procedures for a bidder or offeror to protest the City's award or decision to award a contract.
1. Any protest to award a contract shall be in writing and shall be delivered so that it is received by the City Manager not later than five (5) business days after announcement of the award or decision to award, whichever comes first. Otherwise any such protest shall be deemed to be waived.
 2. Except for a protest of an emergency or sole source procurement, a protest of a City award or decision to award a contract may only be made by a person who submitted a bid or proposal for the procurement at issue and who was reasonably likely to have its bid or proposal accepted but for the City's decision. In the case of an emergency or sole source procurement, a protest may only be made by a person who can show that he was reasonably likely to have submitted a successful bid or proposal if the procurement had been other than emergency or sole source.
 3. Protests shall only be granted if (1) the protester has complied fully with Sec. 18.1-6 of the Lynchburg Public Procurement Code and there has been a violation of

law, the Lynchburg Public Procurement Code, or mandatory terms of the solicitation that clearly prejudiced the protestor in a material way, or (2) a statute requires voiding of the decision.

4. The City Manager shall issue a written decision on a protest within ten (10) days of its receipt by the City Manager.
 5. If the protest is denied, the protestor may only appeal the denial or otherwise contest or challenge the procurement by then filing suit in the Lynchburg Circuit Court, Lynchburg, Virginia, and serving the city with such suit within ten (10) days of such denial. Otherwise, the City Manager's decision shall be final and conclusive, and the protestor's right to appeal the denial or to otherwise contest or challenge the procurement shall be deemed to be waived.
 6. Strictly following these procedures shall be a mandatory prerequisite for protest of the City's award or decision to award a contract. Failure by a bidder to follow these procedures strictly shall preclude that bidder's protest and be deemed to constitute a waiver of any protest.
- b. A protest may not be based upon the alleged non-responsibility of a person to whom the City awards or makes a decision to award a contract.
10. Bidders are referred to the General Conditions for the meanings of capitalized terms.

End of Instructions to Bidders

GENERAL CONDITIONS

ARTICLE 1	CONTRACT DOCUMENTS AND DEFINITIONS
ARTICLE 2	ARCHITECT/ENGINEER
ARTICLE 3	OWNER
ARTICLE 4	CONTRACTOR
ARTICLE 5	SUBCONTRACTORS
ARTICLE 6	WORK BY OWNER OR BY SEPARATE CONTRACTORS
ARTICLE 7	MISCELLANEOUS PROVISIONS
ARTICLE 8	CONTRACT TIME
ARTICLE 9	PAYMENTS AND COMPLETION
ARTICLE 10	PROTECTION OF PERSONS AND PROPERTY
ARTICLE 11	INSURANCE FOR CONTRACTS
ARTICLE 12	CHANGES AND MODIFICATIONS IN THE WORK
ARTICLE 13	CLAIMS AND DISPUTE PROCEDURE
ARTICLE 14	UNCOVERING AND CORRECTION OF WORK
ARTICLE 15	TERMINATION OF THE CONTRACT

GENERAL CONDITIONS

ARTICLE 1 CONTRACT DOCUMENTS AND DEFINITIONS

1.1 DEFINITIONS

1.1.1 CONTRACT AND CONTRACT DOCUMENTS:

The Contract Documents include: (1) the Construction Agreement (the "Contract"), its General Conditions, its Special Conditions (if any) and its attachments (if any); (2) the City's Invitation for Bid No. 14-859 July 2013, and any addenda; (3) the Contractor's bid; (4) the Contract plans, drawings, and specifications and any addenda; and (5) any Modifications and any Field Orders. Any soils, geotechnical or other reports, surveys and analyses which may be made available to the Contractor for review or information under this Contract, are not adopted by reference into, nor are they part of the Contract Documents.

1.1.2 MODIFICATION:

A Modification is (1) a written amendment to the Contract signed by both parties (Project Manager for City of Lynchburg and authorized agent for the Contractor), (2) a written Change Order signed by the Project Manager or Owner's authorized representative and an authorized agent for the Contractor, or (3) a written Change Directive signed by the Owner's authorized representative. Modifications may be made to the Contract and Contract Documents without notice to any surety for the performance or payment bonds for the Work. Any Modification that increases the Contract Sum by more than \$50,000 or that causes total expenditures for the Contract to exceed the amount budgeted for the Contract may only be made with the specific approval of the City Manager.

1.1.3 WORK:

"Work" means the construction and services required by the Contract Documents and includes all services, plant, labor, materials, supplies, equipment and other things necessary for Contractor to carry out and complete the requirements of the Contract Documents. "Work" includes material suitably stored and protected. "Work" also includes any portion of the Work, whether completed or not.

1.1.4 PROJECT:

The Project is the total construction of which the Work performed by Contractor under the Contract Documents may be the whole or a part.

1.1.5 FURNISH, INSTALL & PROVIDE:

The terms "Furnish" or "Install" or "Provide", unless specifically limited in context, mean furnishing and incorporating a specified item, product or material into the Work, including all necessary labor, materials, equipment to make the item and the Work ready for use.

1.1.6 EXTRA WORK:

The term "Extra Work" as used herein, refers to and includes work required by the Owner, which, in the judgment of the Owner involves changes in or additions to the Work required by the Contract Documents in their then-existing form.

1.1.7 NOTICE OF AWARD:

"Notice of Award" is the written notice of the Owner's acceptance of the Contractor's bid given by the Owner to Contractor as the successful bidder.

1.1.8 NOTICE:

"Notice" means written notice made in the manner specified in this paragraph.

any conflict or inconsistency in the Contract Documents, upon its discovery, and promptly submit an explanation in writing of the conflict or inconsistency to the A/E, with a copy to the Owner. The A/E's decision thereon shall be final. In case of conflict or inconsistency between the drawings and the specifications, the specifications shall govern.

- 1.2.4 Should any labor, material, or equipment be required which is not denoted in the drawings and specifications, but which is, nevertheless, reasonably necessary for the proper carrying out of the intent of the Work, it is agreed that the labor, material, or equipment is implied, and the Contractor shall provide such labor and furnish such materials and equipment as fully as if they were completely delineated and prescribed, without additional cost to the Owner.
- 1.2.5 The Contractor may be furnished additional instructions and detail drawings to carry out the Work included in the Contract Documents. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as a part thereof. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.
- 1.2.6 The drawings and specifications are divided into sections for convenience and clarity only. The Contractor shall not construe this division as a division of the Work into various subcontractor units. The Contractor may subcontract the Work in such divisions as he sees fit, but he is ultimately responsible for furnishing all Work required by the Contract Documents.
- 1.2.7 The provisions of this Contract cannot be amended, modified, varied or waived in any respect that causes a change to the Contract Sum or Contract Time except by a Modification. **The Contractor is hereby given notice that no person has authority to orally waive, or to release the Contractor from any of the Contractor's duties or obligations under or arising out of the Contract Documents.** Any waiver, approval or consent granted by Modification or Field Order to the Contractor shall be limited to those matters specifically and expressly stated thereby to be waived, approved or consented to and shall not relieve the Contractor of the obligation to obtain any future waiver, approval or consent.

1.3 OWNERSHIP AND USE OF DOCUMENTS

- 1.3.1 All plans, drawings, specifications, and documents relating to the Work are the property of the Owner and are to be used only for the Project.

ARTICLE 2 ARCHITECT/ENGINEER

2.1 DEFINITIONS

- 2.1.1 The term Architect/Engineer, hereinafter "A/E" or "Architect" or "Engineer", shall mean the consulting firm or City Department/Division, or their duly authorized representatives, lawfully licensed to practice in Virginia, that is responsible for the activities specified herein.
- 2.1.2 Although the A/E is referred to throughout the Contract Documents as if singular in number and masculine in gender, A/E includes plural in number and feminine or neuter in gender, as appropriate.

2.2 ARCHITECT/ENGINEER SERVICES

- 2.2.1 The A/E will provide services as described in these General Conditions.
- 2.2.2 The A/E will advise and consult with the Owner. The Owner's instructions to the Contractor may be forwarded through the A/E. The A/E has authority to act on behalf of the Owner only to the extent

provided in the Contract Documents, and the A/E does not have authority to approve a change to the Contract Sum or the Contract Time.

- 2.2.3 The A/E may visit the site at intervals appropriate to the stage of construction to familiarize himself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. Any visits or inspections by the A/E, any Owner's representative, or any consultant retained by the Owner are solely for the Owner's benefit and shall not confer any rights on Contractor or excuse Contractor from any obligation under the Contract Documents.
- 2.2.4 The A/E will immediately inform the Owner and Contractor whenever, in the reasonable opinion of the A/E, any of the Work is proceeding contrary to the requirements of the Contract Documents and will be unacceptable. Such notification by the A/E is solely for the benefit of the Owner and will not be a cause for the Contractor to claim either delay of the Work or any increase in the Contract Sum or Contract Time.
- 2.2.5 The A/E, the Owner and other governmental representatives shall at all times have access to the Project site and the Work regardless of its stage of progress. The Contractor shall provide facilities for such access so that the A/E, the Owner and other governmental representatives may perform their functions under the Contract Documents.
- 2.2.6 Where applicable, based on the A/E's observations and an evaluation of the Contractor's Applications for Payment, the A/E will recommend the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in Article 99, Payments and Completion.
- 2.2.7 The A/E will be an interpreter of the requirements of the Contract Documents. The A/E will render interpretations necessary for the proper execution and progress of the Work, with reasonable promptness and in accordance with any time limit agreed upon. Either party to the Contract may make written request to the A/E for such interpretations. All interpretations of the A/E shall be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing and/or in the form of drawings.
- 2.2.8 The A/E will recommend to the Owner the rejection of Work that does not conform to the Contract Documents. Whenever, in his opinion, he considers it necessary or advisable for the implementation of the intent of the Contract Documents, he will have authority to require special inspection or testing of the Work in accordance with Subparagraph 7.6.2 whether or not such Work be then fabricated, installed or completed.
- 2.2.9 The A/E will review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data, Samples and Manuals, but only for conformance with the design concept of the Work and with the information given in the plans, drawings, and specifications. Contractor shall ensure that all submittals are complete and have had included with them all correlated items that the A/E requires for his review. In the A/E's and Owner's sole discretion, the A/E may decline to review partial submittals or submittals for which correlated items have not been included. Contractor shall clearly note, both in a cover letter with any submittal and on the submittal itself, any deviation or inconsistency of anything submitted with the requirements of the Contract Documents. The A/E's approval of a specific item shall not indicate approval of an assembly of which the item is a component. The A/E's review and approval is for the sole benefit of the Owner and is not for the benefit of the Contractor. The A/E's review and approval shall in no way excuse Contractor from fully complying with the Contract Documents.
- 2.2.10 The A/E's acceptance of materials or products on behalf of the Owner shall not bar future rejection of such items (a) if they are subsequently found to be defective or inferior in quality or uniformity to the materials or products specified by the Contract Documents, (b) if such materials or products are not as

represented by the Contractor, or (c) if such materials or products do not conform to the requirements of the Contract Documents.

- 2.2.11 As required, the A/E will conduct inspections to assist the Owner in determining the dates of Substantial Completion and Final Completion, will receive and forward to the Owner for the Owner's review written warranties and related documents required by the Contract Documents and assembled and submitted by the Contractor, and will recommend a final Certificate for Payment upon Contractor's full compliance with the requirements of Article 9, Payment and Completion.
- 2.2.12 All claims, disputes, or other matters or questions between the Contractor and Owner arising out of or relating to the A/E's interpretation of the Contract Documents or arising out of any other decisions, communications, or actions of the A/E relating to the performance of the Work shall be resolved as set forth in Article 12, Changes and Modifications in the Work, and Article 13, Claims.
- 2.2.13 In case of the termination of the employment of the A/E, the Owner shall appoint a new A/E, who shall have the same status under the Contract Documents as the former A/E.

ARTICLE 3 OWNER

3.1 *DEFINITION*

- 3.1.1 The Owner is the City of Lynchburg, Virginia ("City"). The term Owner means the Owner or its authorized representative. The Departmental Director, or his designee, is the authorized Owner's representative for this Contract. Notwithstanding the foregoing, the authority of the Owner's representative is subject to the limitations in the Lynchburg Public Procurement Code.
- 3.1.2 The Departmental Director, will designate a single Owner's representative, with the title of Project Manager (PM), who will have the power to act, within the scope of his delegated authority, for and on behalf of the Owner, in accordance with the terms of the Contract Documents.
- 3.1.3 For purposes of any change in the Work, the term "Owner" or "Owner's representative" specifically excludes any and all inspectors having building code or City ordinance responsibilities or jurisdiction under the requirements of the building permit for the Project.

3.2 *INFORMATION POSSESSED BY OWNER*

- 3.2.1 The Owner, as a courtesy, may make available for the Contractor's reasonable review, at the Owner's offices or together with the Contract Documents, certain boring logs, geotechnical, soils and other reports, surveys and analyses pertaining to the Project site. Any such information provided to the Contractor is intended to be for the Contractor's convenience only, and its accuracy and completeness are not guaranteed or warranted by the Owner or the A/E, it being the Contractor's sole responsibility to verify the accuracy and completeness of such information. Such information is not incorporated by reference into or made a part of the Contract Documents.
 - 3.2.1.1 Notwithstanding any information provided by Owner or anyone acting on the behalf of Owner, the Contractor assumes full responsibility for inspection of the site and for the means and methods of construction that he employs when performing the Work. The Owner shall not be liable for any additional work or costs arising as a result of any conclusions reached or assumptions derived by the Contractor from or based upon any such information that the Owner makes available for the Contractor's convenience.

3.3 *OWNER-PAID PERMITS AND FEES*

3.3.1 The Owner will, where applicable, pay for:

.1 Sewer availability fees;

.2 Water availability/meter connection fee;

.3 Electrical, natural gas, telephone, and cable TV permanent installation charges;

.4 Any easements required;

.5 Railroad flagging services; and

.6 Permits for work in Virginia Department of Transportation (VDOT) right-of-way. The Contractor is required to comply with the general requirement for work in the VDOT right-of-way as outlined in the The Manual of Specifications and Standard Details, 2005 for the City of Lynchburg, and the VDOT Manual for this work. Upon completion of all work in the VDOT right-of-way, the VDOT Personnel will conduct an inspection and issue a punch list. The Contractor shall be responsible for completion of those items on the punch list and for obtaining the written release of the permit.

3.3.2 The Contractor's attention is directed to Article 4.7, Contractor-Paid Taxes, Permits, Fees, and Notices, describing other permits to be obtained and fees to be paid by the Contractor.

3.4 OWNER'S RIGHT TO STOP WORK

3.4.1 If the Contractor fails to correct defective Work as required herein or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner, by a written order, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

3.5 OWNER'S RIGHT TO CARRY OUT THE WORK

3.5.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven (7) days after receipt of Notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedy he may have, rectify such deficiencies, including without limitation, by performing the Work or having the Work performed by other contractors, as outlined in Section 6.1, Owner's Right to Perform Work and to Award Separate Contracts. In such case, an appropriate Change Order or Change Directive shall be issued by Owner deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the A/E's additional services made necessary by such default, neglect or failure. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

3.5.2 Neither the Owner nor the A/E nor their officers, agents, assigns or employees are in any way liable or accountable to the Contractor or his surety for the method by which Work performed by the Owner or performed by other contractors pursuant to this Article 3.5, or any portion thereof, is accomplished or for the price paid therefore. Notwithstanding the Owner's exercise of its rights under this Article 3.5, the Contractor and its surety shall have sole responsibility to maintain and protect the Work, including without limitation, that portion of the Work performed by or on behalf of Owner pursuant to this Article 3.5.

3.6 *SUSPENSION OF WORK*

- 3.6.1 The Owner shall have the authority to suspend the Work, in whole or in part, for such periods and such reasons as the Owner may deem necessary or desirable, in its sole discretion, including without limitation:
- .1 Unsuitable weather;
 - .2 Other conditions considered unfavorable for the suitable prosecution of the Work; and/or
 - .3 Other conditions considered adverse to the best interests of the Owner.
- 3.6.2 Any such suspension shall be made by Owner by written order to the Contractor. The Contractor shall obey immediately such order of the Owner and shall not resume the Work until so ordered in writing by the Owner. The Contractor shall be entitled to an extension of the Contract Time, subject to the provisions of Article 8, Contract Time, herein.
- 3.6.3 No such suspension of the Work shall be the basis of a claim by the Contractor for any increase in the Contract Sum or for any other damages, losses, costs or expenses if the suspension is for a reasonable time under the circumstances then existing and the cause thereof is beyond the control and is without the fault or negligence of the Owner or those acting on Owner's behalf.
- 3.6.4 In the event of suspension of Work, the Contractor will, and will cause his Subcontractors and others providing any of the Work through Contractor to, protect carefully his and their materials and Work against damage or injury from the weather and maintain completed and uncompleted portions of the Work as required by the Contract Documents. If, in the opinion of the Owner, any Work is damaged or injured by reason of failure on the part of the Contractor or any of his subcontractors to so protect same, such Work shall be removed and replaced at the expense of the Contractor.

3.7 *USE AND OCCUPANCY PRIOR TO FINAL ACCEPTANCE BY OWNER*

- 3.7.1 The Owner has the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding that the time for completing the entire Work or any portions thereof may, or may not, have expired. The taking of possession and use by the Owner shall be in accordance with the provisions in Article 9.8, Substantial Completion and Guarantee Bond. If such prior use delays the Work, the Contractor may submit a request for a time extension in accordance with the requirements of Article 8, Contract Time.

3.8 *RIGHT TO AUDIT AND PRESERVATION OF RECORDS*

- 3.8.1 The Contractor shall maintain books, records and accounts that completely and accurately account for all of his costs and receipts relating to the Project in accordance with generally accepted accounting principles and practices. The Owner or its authorized representatives shall have the right to review, inspect, audit and/or copy the books, records, accounts and related documents, including without limitation, supporting documents, of the Contractor under any of the following conditions:
- .1 If the Contract is terminated for any reason in accordance with the provisions of these Contract Documents, in order to arrive at equitable termination costs;
 - .2 If the Contractor and the Owner dispute the amount due the Contractor under the terms of this Contract;
 - .3 To check or substantiate any amounts invoiced or paid that are required to reflect the costs of the Contractor, or the Contractor's efficiency or effectiveness under this Contract or in connection with

any extras, changes, claims, additions, backcharges, or other, as may be provided for in this Contract; and/or

.4 If it becomes necessary to determine the Owner's rights and the Contractor's obligations under the Contract or to ascertain facts relative to any Claim.

- 3.8.2 These provisions for review, inspection, audit and copying shall give the Owner unlimited access during normal working hours to the Contractor's books, records, accounts and supporting documents under the conditions stated above.
- 3.8.3 The Contractor shall make all his books, records, accounts, and all other documents relating to his costs and receipts under this Contract, including without limitation any supporting documents, available to the Owner and its representatives for review, audit, inspection and copying at any time during the period from entry into this Contract through three years after Final Payment or termination of this Contract, whichever occurs later.
- 3.8.4 Any payments made under this Contract shall not constitute a waiver of the Owner's rights to review, inspect, copy and audit. Payments shall not constitute a waiver or agreement by the Owner that it accepts as correct the billings, invoices or other charges upon which the payments are based. If the Owner's review and audit produces a claim against the Contractor, the Owner may pursue all its legal remedies, even though Owner has made all or part of the payments required by this Contract.
- 3.8.5 If any review or audit by the Owner or the Owner's representatives discloses an underpayment by the Owner, the Owner shall pay any amounts found by the audit to be owed to the Contractor. If such audit discloses an overpayment, the Contractor reimburse the Owner for the amount of the overpayment.
- 3.8.6 The Owner's right to review, inspect, audit and copy, and the Contractor's duty as to preservation of records shall terminate at the end of three (3) years after Final Payment or termination of this Contract, whichever occurs later. The Contractor shall include this "Right to Audit and Preservation of Records" clause in all his subcontracts, and he shall require the same to be inserted by all Subcontractors and lower-tier subcontractors in their subcontracts; for any portion of the Work. Should Contractor fail to cause this clause to be included in any such subcontract or lower tier subcontract or otherwise fail to ensure the Owner's rights under this Article 3.8, Contractor shall be liable to Owner for all costs, expenses and attorney's fees that Owner may incur in order to obtain the information that would have otherwise been available to Owner under this Article 3.8, and the absence of such information shall create a presumption in the Owner's favor, which Contractor must overcome with clear and convincing evidence, that the missing information does not support the payment to Contractor or Contractor claim at issue.
- 3.8.7 Review, inspection, audit and copying pursuant to this Article 3.8 may be conducted by the Owner or its authorized representatives.
- 3.8.8 Documents subject to this Article 3.8 shall be made available to Owner and its representatives in whatever formats Owner requests, including without limitation, any electronic formats and/or in paper formats.

3.9 RIGHT TO REVIEW OTHER DOCUMENTS AND MATERIALS

- 3.9.1 In addition to the rights granted to the Owner under Article 3.8, Right to Audit and Preservation of Records or Documents, the Owner shall have the right to inspect, review and copy any and all of the Contractor's records or documents pertaining to or relating in any way to the Work, including, but not limited to, correspondence, memoranda, minutes, reports, intra- and inter-office communications, work papers, estimating sheets, progress reports, forecasts, audio or video recordings, computer disks, e-mails, films, or any other materials, regardless of physical form or characteristics, which were prepared by or in

the possession of, or obtainable by, the Contractor. The Contractor shall make all such documents and records available to the Owner upon ten (10) days Notice to the Contractor of the Owner's intent to inspect and review such documents. The Contractor shall include this "Right to Review Documents and Other Materials" clause in all its subcontracts, and Contractor shall cause the same to be inserted by all Subcontractors and lower-tier subcontractors in their subcontracts for any portion of the Work. The Contractor hereby waives any right he may have to additional compensation or time extensions in the event he fails or refuses to preserve and produce records pertaining to any such claim as requested by the Owner pursuant to this paragraph. In addition, the Owner may withhold all or any portion of any progress payments, which may be otherwise due, in the event Contractor refuses to comply with its obligations under this Article 3.9. The review, inspection and copying of documents and other records under this Article 3.9 may be conducted by the Owner or its authorized representatives.

- 3.9.2 Records and documents subject to this Article 3.9 shall be made available to Owner and its representatives in whatever formats Owner requests, including without limitation, any electronic formats and/or in paper formats.

ARTICLE 4 CONTRACTOR

4.1 DEFINITION

- 4.1.1 The Contractor is the person or entity identified in the Contract as such, and is generally referred to throughout the Contract Documents as if singular in number and masculine in gender but includes the feminine and neuter in gender, as appropriate. The term Contractor means the Contractor or his authorized representative.
- 4.1.2 This entire Contract is not one of agency by the Contractor for Owner but one in which the Contractor is engaged independently in the business of providing the services and performing the Work herein described as an independent contractor.

4.2 REVIEW OF CONTRACT DOCUMENTS

- 4.2.1 The Contractor shall not perform any portion of the Work at any time without having obtained and carefully reviewed the Contract Documents or, where required, approved Shop Drawings, Product. Data, Samples or Manuals for such portion of the Work.
- 4.2.2 The Contractor shall keep at the Project site at least two (2) copies of the drawings and specifications and shall at all times give the A/E, inspectors, and representatives of the Owner access thereto. Further, said drawings and specifications shall be the approved sets issued to the Contractor by the appropriate City permit agencies

4.3 CONTRACTOR'S REPRESENTATIONS

By entering into this Contract with the Owner, the Contractor represents and warrants the following, together with all other representations and warranties in the Contract Documents

- 4.3.1 That he is experienced in and competent to perform the type of work required and to furnish the plant, materials, supplies or equipment to be so performed or furnished by him;
- 4.3.2 That he is financially solvent, able to pay his debts as they mature, and possessed of sufficient working capital to initiate and complete the Work required by the Contract Documents;
- 4.3.3 That he is familiar with all federal, state, and local government laws, ordinances, permits, regulations and resolutions that may in any way affect the Work or those employed therein;

- 4.3.4 That such temporary and permanent Work required by the Contract Documents which is to be done by him will be satisfactorily constructed and fit for use for its intended purpose and that such construction will not injure any person, or damage any property;
- 4.3.5 That he has carefully examined the Contract Documents and the site of the Project and the Work and that from his own investigations, he has satisfied himself and made himself familiar with: (1) the nature and location of the Work, (2) the character, quality and quantity of materials likely to be encountered, including, but not limited to, all structures and obstructions on or at the project site, both natural and man-made; (3) the character of equipment and other facilities needed for the performance of the Work, (4) the general and local conditions, including without limitation its climatic conditions, the availability and cost of labor and the availability and cost of materials, tools and equipment; (5) the quality and quantity of all materials, supplies, tools, equipment, labor and professional services necessary to complete the Work in the manner required by the Contract Documents; and (6) all other matters or things which could in any manner affect the performance of the Work;
- 4.3.6 That he will fully comply with all requirements of the Contract Documents;
- 4.3.7 That he will perform the Work consistent with good workmanship, sound business practice, and in the most expeditious and economical manner consistent with the best interests of the Owner;
- 4.3.8 That he will furnish efficient business administration, an experienced superintendent, and an adequate supply of workmen, equipment, tools and materials at all times;
- 4.3.9 That he will complete the Work within the Contract Time;
- 4.3.10 That his Contract Sum is based upon the labor, materials, systems and equipment required by the Contract Documents, without exception; and
- 4.3.11 That he has satisfied himself as to the feasibility and correctness of the Contract Documents for the construction of the Work.

4.4 SUPERVISION AND CONSTRUCTION PROCEDURES

- 4.4.1 The Contractor shall supervise and direct the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract; subject, however, to the Owner's right to reject means and methods proposed by the Contractor which are unsafe or otherwise not in compliance with the Contract Documents.
- 4.4.2 The Contractor shall be responsible to the Owner for the acts and omissions of Contractor's employees, Subcontractors and sub-subcontractors, suppliers, their agents and their employees, and of any other persons providing any of the Work through Contractor, and for their compliance with each and every requirement of the Contract Documents, in the same manner as if they were directly employed by the Contractor.
- 4.4.3 The Contractor understands and agrees that he shall not be relieved of his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Owner or the A/E in their administration of the Contract or by inspections, tests, or approvals required or performed under Article 7 by persons other than the Contractor.
- 4.4.4 Before starting a section of the Work, the Contractor shall carefully examine all preparatory work that has been executed by others to receive his Work to see that it has been completed. He shall check carefully,

by whatever means are required, to ensure that his Work and adjacent, related work will finish to proper quality, contours, planes, and levels.

- 4.4.5 The Contractor understands and agrees that the Owner and A/E will not have any liability for or any responsibility to exercise any control over construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and they will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Owner and the A/E will not have any liability for or any responsibility to exercise any control over the acts or omissions of the Contractor, Subcontractors, sub-subcontractors or any of their agents or employees, or any other persons performing any of the Work.
- 4.4.6 The Contractor shall use no plant, equipment, materials, or persons for this Work to which the Owner objects.
- 4.4.7 The Contractor shall not remove any portion of the Work or stored materials from the site of the Project without the Owner's prior, written approval.

4.5 LABOR, MATERIALS AND EQUIPMENT

- 4.5.1 The Contractor shall furnish all plant, labor, materials, supplies, equipment and other facilities and things necessary or proper for, or incidental to, the Work, and will perform all other obligations imposed on him by the Contract Documents. Final payment will not be made until the Work is so completed.
- 4.5.2 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.
- 4.5.3 Work, materials, and equipment which are necessary in the construction but which are not specifically referred to in the specifications or shown in the drawings but implied by the Contract Documents shall be furnished by the Contractor at his own cost and expense. Such work and materials shall correspond with the general character of the Work as may be determined by the A/E subject to review as provided in Article 2.2.11.
- 4.5.4 The Contractor shall perform at least that percentage of the Work specified in the Contract to be Contractor self performed with forces that are in the direct employment of the Contractor. The Contractor shall submit to the Owner within thirty (30) days after award of the Contract a designation of the Work to be performed by the Contractor with his own forces. The percentage of the Work to be performed under subcontract shall be calculated by adding the amounts of all subcontracts and dividing this sum by the total Contract Sum.
- 4.5.5 The Contractor shall at all times enforce strict discipline, safety and good order among all persons providing any of the Work through him and shall not cause or allow to be used for the Work any unfit person or anyone not skilled in the task assigned to him. If any person providing any of the Work through the Contractor shall appear to the Owner to be incompetent or to act in a disorderly or improper manner, such person shall be removed immediately, at the request of the Owner, and shall not provide any of the Work except on written consent of the Owner.
- 4.5.6 No materials or supplies for the Work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage, or under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the Work.

- 4.5.7 The Contractor shall provide approved and adequate sanitary accommodations. All wastes shall be covered, disinfected, incinerated or otherwise disposed of legally.
- 4.5.8 All equipment, apparatus and/or devices of any kind to be incorporated into the Work that are shown or indicated on the drawings or called for in the specifications or required for the completion of the Work shall be entirely satisfactory to the Owner as regards operation, capacity and/or performance. No approval, either written or verbal, of any drawings, descriptive data or samples of such equipment, apparatus, and/or device shall relieve the Contractor of his responsibility to turn over the same in good working order for its intended purpose at the completion of the Work in complete accordance with the Contract Documents. Any equipment, apparatus and/or device not fulfilling these requirements shall be removed and replaced by Contractor with proper and acceptable equipment, apparatus, and/or device, or put in good working order satisfactory to the Owner by Contractor without additional cost to the Owner.

4.6 WARRANTY

- 4.6.1 The Contractor warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all workmanship will be of first class quality, free from faults and defects and in conformance with the Contract Documents and all other warranties and guaranties specified therein. Where no standard is specified for such workmanship or materials, they shall be the best of their respective kinds. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This warranty is not limited by the provisions of Article 13, Uncovering and Correction of Work.
- 4.6.2 The Work included in this Contract is specified in the Contract Documents. The Contractor shall be required to complete the Work specified and to provide all items needed for construction of the Work, complete and in good order.

4.7 CONTRACTOR-PAID TAXES, PERMITS, FEES AND NOTICES

- 4.7.1 The Contractor shall pay all sales, consumer, use and other similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective. Taxes to be paid by the Contractor shall include, but shall not be limited to, the Lynchburg City Business, Professional and Occupational License Tax (a gross receipts tax).
- 4.7.2 Except as provided in Article 3.3, Owner-Paid Permits and Fees, the Contractor will be responsible for obtaining and paying for all other fees, permits and licenses necessary for the proper execution of the Work, including but not limited to:
- .1 Building Permit and inspections (City fees waived);
 - .2 Plumbing, Electrical, Mechanical Permits and inspections (City fees waived);
 - .3 Temporary water meter, temporary electrical and telephone installations and temporary utility usage;
 - .4 Temporary security lighting;
 - .5 All other permits necessary in order to perform the Work shall also be secured by the Contractor, and fees necessary in order to perform the Work shall be paid by him as part of this Contract at no additional cost to the Owner.

4.7.3 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, codes, permits, resolutions and lawful orders of any public authority bearing on the performance of the Work; including but not limited to OSHA, Title 40.1 Labor and Employment Chapter 3 of the Code of Virginia, and Title VII of the Civil Rights Act of 1964, as amended. All safety violations shall be corrected immediately upon receipt of notice of violation.

4.8 COMPLIANCE

4.8.1 All demolition and excavation shall comply with all laws, ordinances, rules and regulations, and lawful orders of public authority, including without limitation, those for the prevention of accidents as issued by the Department of Labor and Industry of the Commonwealth of Virginia.

4.8.2 To the extent of the Work indicated in the Contract Documents, the Contractor shall comply and the construction shall conform with all applicable and current editions or revisions of the following codes, specifications and standards. In case of conflict, the order of precedence shall be as hereinafter listed:

.1 Lynchburg Public Procurement Code;

.2 Contract Documents;

.3 The Virginia Uniform Statewide Building Code ("USBC"), as amended including, without limitation, The International Building Code ("IBC") and other codes incorporated by the USBC and IBC); and

.4 The Virginia Department of Transportation Road and Bridge Specifications and the Road Designs and Standards.

4.8.3 If the Contractor (or any person in a contract with the Contractor relating to the Work) finds an error, inconsistency, omission, ambiguity, discrepancy, conflict or variance in the Contract Documents, or between the Contract Documents and any provisions of law, ordinance, rule, or regulations or any of the codes, specifications and standards set forth in 4.8.2 herein, the Contractor has the obligation to promptly seek in writing a clarification thereof from the A/E, with a copy to the Owner, prior to the time of beginning any of the Work that is affected by such error, inconsistency, omission, ambiguity, discrepancy, conflict or variance. The Owner will welcome such a clarification request, and, if deemed necessary by the Owner, the Owner will issue a written instruction clarifying the matter in question. If the Contractor feels that the written clarification requires additional work, the Contractor shall follow the change process in Article 12, Changes and Modifications in the Work.

Should the Contractor fail to seek such a clarification thereof immediately upon the discovery of the need therefor, prior to the time the said Work is performed, the Contractor thereby assumes all risk of loss related to such error, inconsistency, ambiguity, discrepancy, conflict or variance which the Contractor (and any person in contract with Contractor relating to the Work) knew or should have known, using a normal, professional standard of care, existed prior to the time the Work was performed.

4.8.4 Any material or operation specified by reference to publications, or published specifications of a manufacturer, a society, an association, a code, or other published standard, shall comply with the requirements of the referenced document which is current on the date of receipt of bids. If the Contractor observes that any of the Contract Documents are at variance with any such referenced publications, codes, published specifications, or published standards in any respect, he shall promptly notify the A/E in writing, with a copy to the Owner. The A/E will make such judgments as are necessary and notify the Contractor prior to the performance of the Work.

- 4.8.5 If the Contractor performs any Work contrary to any law, code, ordinance, regulation, publication, standard, permit, rule, regulation or resolution, he shall assume full responsibility therefore and shall bear all costs attributable thereto.
- 4.8.6 The Contractor is responsible for locating all underground structures such as water, oil and gas mains, water and gas services, storm and sanitary sewers and telephone and electric conduits that may be encountered during construction. The Contractor shall have Miss Utility locate all utilities on the site within the area of the Work and shall dig test holes, to determine the position of the underground structures. The Contractor shall pay the cost of digging test holes and likewise he shall pay the cost of the services of the representatives of the owners of such utilities for locating the said utilities. The cost of determining the location of any and all utilities is to be included in the bid price. The Owner shall pay the owners of such utilities for fees or charges for relocation of gas, electric, telephone, cable or other lines and/or services indicated to be relocated by others.
- 4.8.7 If utilities are marked which are not shown on the plans, the Contractor shall immediately give Notice to the Owner and the A/E of such finding. The Owner and A/E shall provide a direction to the Contractor within a reasonable period of time if additional work is required as a result of the finding. If the Contractor believes that it requires additional work, the Contractor shall follow the change process in Article 12, Changes and Modifications in the Work.

4.9 ALLOWANCES

- 4.9.1 The Special Conditions, if any, will contain provisions for allowances, if applicable to this Contract.

4.10 SUPERINTENDENT

- 4.10.1 The Contractor shall employ and have present at the Project site a competent Superintendent and any necessary assistants to ensure adequate supervision of the Work. The Superintendent shall have full authority to represent the Contractor, and all communications given to the Superintendent shall be as binding as if given to the Contractor.
- 4.10.2 Such Superintendent shall be acceptable to the Owner and shall be one who will be continued in that capacity for duration of this Project, unless he ceases to be on the Contractor's payroll. The Superintendent shall not be employed on any other project during the performance of this Contract.

4.11 CONSTRUCTION SCHEDULE

- 4.11.1 The Contractor shall, within twenty (20) days after issuance of the Notice of Award, prepare and submit to the A/E and Owner for review, a reasonably practicable and feasible Construction Schedule, showing the method by which the Contractor will comply with Completion Date requirements as set forth in the Contract. Unless otherwise agreed in writing by Owner or indicated in the specifications, the Construction Schedule shall use the Critical Path Method ("CPM") and an industry-standard computer software program, such as Primavera, acceptable to Owner and A/E, and shall be provided in electronic and paper format. The Construction Schedule shall show in detail how the Contractor plans to execute and coordinate the Work. The Contractor shall use this schedule in the planning, scheduling, direction, coordination and execution of the Work. The Construction Schedule shall encompass all of the work of all trades necessary for construction of the Project and shall be sufficiently complete and comprehensive to enable progress to be monitored on a day-to-day basis. The Owner and A/E shall each be provided with a copy of all schedules, updates, reports and other documentation required herein, which shall be suitable for reproduction by the Owner, and, unless otherwise agreed by Owner, shall be in electronic and paper format. When required to assist the A/E with Project staffing requirements for the following week, the Contractor shall provide the A/E, on each Friday, with a detailed work schedule for the following week. The Contractor shall provide the A/E with at least a seventy-two (72) hour notice for the following

items: (1) All traffic lane changes, (2) Work ready for inspection or testing, (3) _____. The Contractor may be charged for additional costs of inspection when material and workmanship are found to not be ready for inspection or testing at the time the Contractor calls for inspection or testing.

- 4.11.2 It is the sole responsibility of the Contractor to prepare, maintain, update, revise and utilize the Construction Schedule as outlined in this Article 4.11, Construction Schedule. The Construction Schedule shall be the sole overall schedule utilized by the Contractor in managing this Project; provided, however, that Contractor may, at its option, employ and utilize other schedules based upon and consistent with the Construction Schedule. In general, it is the intent of this paragraph 4.11.2 to allow the Contractor to choose its own means, methods and construction procedures consistent with good practice and the Contract Documents.
- 4.11.3 If the Contractor should express an intention to complete the Work earlier than any required Milestone or Completion Date, including without limitation, in any schedule, the Owner shall not be liable to the Contractor for any delay or associated extra costs based upon the Contractor being unable to complete the Work before such earlier date. The duties, obligations and warranties of the Owner to the Contractor apply only to the completion of the Work on the Milestone and Completion Dates required by the Contract Documents and do not apply to early completion.
- 4.11.4 Submission to the Owner of the Construction Schedule is advisory only, does not satisfy any requirement for any notice required by the Contract Documents or the Lynchburg Public Procurement Code, and such submission shall not relieve the Contractor of the responsibility for accomplishing the Work within each and every required Milestone and Completion Date. Omissions and errors in the approved Construction Schedule shall not excuse performance that is not in compliance with the Contract Documents. Submission to the Owner and/or A/E in no way makes the Owner and/or A/E an insurer of the Construction Schedule's success or makes Owner and/or the A/E liable for time or cost overruns flowing from the Construction Schedule's shortcomings. The Owner hereby disclaims any obligation or liability by reason of Owner and/or A/E approval or failure to object to the Construction Schedule, and any such approval or failure to object shall not be considered an admission by the Owner that the Construction Schedule was reasonably practicable or feasible.
- 4.11.5 Contractor shall consult with and obtain information from principal Subcontractors necessary in preparation of the Construction Schedule, and for updates and revisions required therein. Contractor shall provide each principal Subcontractor with copies of the Construction Schedule and any revisions or updates affecting that Subcontractor's work. Contractor shall hold appropriate progress meetings with Subcontractors and shall direct and coordinate the work of Subcontractors consistent with and as required herein. Owner shall have the right to attend Subcontractor progress meetings but shall not be required to participate in such meetings or provide information to Subcontractors, except through the Contractor. Contractor shall keep up-to-date minutes of subcontractor progress meetings and shall provide same to Owner. The Contractor shall ensure that each Subcontractor, sub-subcontractor or supplier acknowledges and accepts the requirements of the Construction Schedule relating to their part of the Work.
- 4.11.6 If Contractor's Construction Schedule indicates that Owner, the A/E, or a separate contractor is to perform an activity by a specific date, or within a certain duration, Owner, the A/E, or any separate contractor shall not be bound to said date or duration unless Owner expressly and specifically agrees in writing to the same. The Owner's and/or A/E's overall review and acceptance or approval of the schedule does not constitute an agreement to specific dates or durations for activities of the Owner, A/E, or any separate contractor.
- 4.11.7 The Contractor's Superintendent shall maintain at the Project site a current, updated Construction Schedule, indicating actual monthly progress for those portions of the Project on which Work has been or is being performed.

- 4.11.8 If an extension or contraction of any Milestone or Completion Date is authorized by any Change Order, the Contractor shall revise his Construction Schedule, Milestone and Completion Dates accordingly.
- 4.11.9 If, in the opinion of the Owner, the Construction Schedule does not accurately reflect the actual progress and sequence of the Contractor's performance of the Work, the Contractor shall revise the Construction Schedule, upon the Owner's request, and submit a revised Construction Schedule that accurately represents the progress and sequence of the Contractor's performance of the Work.
- 4.11.10 Contractor shall submit to the Owner the name of any scheduling consultant that Contractor may select or retain, prior to using such consultant. Contractor shall not utilize any particular scheduling consultant over the reasonable objection of the Owner to that consultant.
- 4.11.11 Contractor covenants, warrants, and guarantees that Contractor will not:
- .1 Misrepresent to Owner its planning and scheduling of the Work;
 - .2 Utilize schedules materially different from those made available to the Owner or any subcontractors for the direction, execution and coordination of the Work, or which are not feasible or realistic;
 - .3 Prepare schedules, updates, revisions or reports that do not accurately reflect Contractor's actual intent or Contractor's reasonable and actual expectations as to:
 - (a) The sequences of activities,
 - (b) The duration of activities,
 - (c) The responsibility for activities,
 - (d) Resource availability,
 - (e) Labor availability or efficiency,
 - (f) Expected weather conditions,
 - (g) The value associated with the activity,
 - (h) The percentage complete of any activity,
 - (i) Completion of any item of work or activity,
 - (j) Project completion,
 - (k) Delays, slippages, or problems encountered or expected,
 - (l) Subcontractor requests for time extension, or delay claims of subcontractors, and
 - (m) If applicable, the float time available.
- 4.11.12 Contractor's failure to substantially comply with the foregoing covenants, warranties and guarantees of paragraph 4.11.11 shall be a substantial and material breach of contract which will permit Owner to terminate Contractor for default; or withhold payments under the Contract Documents; and shall entitle Owner to the damages afforded by these Contract Documents or applicable law.

- 4.11.13 Should Contractor fail to substantially comply with the provisions of the Contract Documents relating to scheduling and execution of the Work by the overall Construction Schedule, Owner shall have the right, at its option, to retain the services of scheduling consultants or experts (including attorneys if necessary in the opinion of the Owner) to prepare schedules, reports, updates and revisions of the schedule in accordance with the Contract Documents and to review and analyze same, in order to allow Owner and the A/E to evaluate the progress of the Work by Contractor, to determine whether Contractor is substantially complying with the Contract Documents, and to direct such action by the Contractor, as permitted by the Contract Documents, as required to ensure, under the Owner's schedule prepared hereunder, that Contractor will complete the Work within the Contract Time. All costs and expenses and fees incurred by Owner in exercising its rights hereunder shall be charged to Contractor's account. If Contractor fails to substantially comply with the scheduling and execution of the Work requirements of the Contract Documents, Contractor hereby agrees, in such instance, to comply with such Owner-prepared schedules, if any, or directions, activity sequences and durations as Owner may reasonably require, without additional cost to the Owner (subject only to cost adjustments for such changes in the Work as Owner may direct), to ensure completion within the Contract Time.
- 4.11.14 The Construction Schedule shall be utilized by Owner, A/E and Contractor for submission, review and approval of monthly Payment Requests. The schedule must be updated by Contractor monthly with each progress payment application and submitted to the Owner and A/E for review with the progress payment application. Owner shall not be required to process and review Contractor's Application for Payment if Contractor has failed or refused to provide the scheduling update information required herein.
- 4.11.15 The type of schedule to be utilized on this Project, along with its particular elements, shall be as specified in the Contract Documents.

4.12 RESPONSIBILITY FOR COMPLETION

4.12.1 The Contractor shall furnish such manpower, materials, facilities and equipment and shall work such hours, including night shifts, overtime operations and Sundays and holidays, as may be necessary to ensure the performance of the Work within the Milestone and Completion dates specified in the Contract. If the Owner notifies the Contractor that it has become apparent that the Work will not be completed within required Milestone or Completion Dates and such is not due solely to circumstances for which Contractor has established entitlement to an extension to the Contract Time, the Contractor agrees that it will assume full responsibility to take some or all of the following actions, at no additional cost to the Owner (except for circumstances beyond the Contractors' control), in order to ensure, in the opinion of the Owner, that the Contractor will comply with all Milestone and Completion Date requirements:

- .1 Increase manpower, materials, crafts, equipment and facilities;
- .2 Increase the number of working hours per shift, shifts per working day, working days per week, or any combination of the foregoing; and
- .3 Reschedule activities to achieve maximum practical concurrency of accomplishment of activities.

Failure of the Owner to notify the Contractor of the apparent delay shall not relieve Contractor of the obligation to finish the Work within the required Milestone or Completion date.

4.12.2 If the actions taken by the Contractor to remedy delays not due solely to circumstances for which Contractor has established entitlement to a time extension are not satisfactory, the Owner may direct the Contractor to take any and all actions necessary to ensure completion within the required Milestone and

Completion Dates, without additional cost to the Owner. In such event, the Contractor shall continue to assume responsibility for his performance and for completion within the required dates.

- 4.12.3 If, in the opinion of the Owner, the actions taken by the Contractor pursuant to this Article or the progress or sequence of Work are not accurately reflected on the Construction Schedule, the Contractor shall revise such schedule to accurately reflect the actual progress and sequence of Work.
- 4.12.4 Failure of the Contractor to substantially comply with the requirements of this Article is grounds for a determination by the Owner, pursuant to Article 15, Termination Of The Contract, that the Contractor is failing to prosecute the Work with such diligence as will ensure its completion within the time specified.
- 4.12.5 The Owner may, at its sole discretion and for any reason, including when it is apparent to the A/E or Owner that the Work will not be completed within the required Milestone or Completion Dates, require the Contractor to accelerate the Construction Schedule by providing overtime, Saturday, Sunday and/or holiday work and/or by having all or any subcontractors designated by the Owner provide overtime, Saturday, Sunday, and/or holiday work. If the Owner requires overtime, Saturday, Sunday or holiday work by the Contractor's or his Subcontractor's own forces, and such requirement is not related in any way to the Contractor's apparent inability to comply with Milestone and Completion Date requirements, the Owner shall reimburse the Contractor for the direct cost to the Contractor of the premium time for all labor utilized by the Contractor in such overtime, Saturday, Sunday or holiday work (but not for the straight time costs of such labor), together with any Social Security and State or Federal unemployment insurance taxes in connection with such premium time. However, no overhead supervision costs, commissions, profit or other costs and expenses shall be payable in connection therewith.
- 4.12.6 This provision does not eliminate the Contractor's responsibility to comply with the City's noise ordinances, all VDOT permit requirements, and all other applicable laws, regulations, rules, ordinances, resolutions, and permit requirements.

4.13 DOCUMENTS AND SAMPLES AT THE SITE

- 4.13.1 The Contractor shall, at the Owner's direction, maintain at the site for the Owner one record copy of all drawings, specifications, addenda, Change Orders and other Modifications, and Field Orders in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data, Samples and Manuals. These shall be available to the A/E. These shall be delivered to the Owner upon completion of the Work.

4.14 SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND MANUALS

- 4.14.1 SHOP DRAWINGS are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
- 4.14.2 PRODUCT DATA are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
- 4.14.3 SAMPLES are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.
- 4.14.4 MANUALS are manufacturer's installation, start-up, operating, maintenance and repair instructions, together with parts lists, pictures, sketches and diagrams that set forth the manufacturer's requirements, for the benefit of the Contractor and the Owner.

- 4.14.5 The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data, Samples and Manuals required by the Contract Documents.
- 4.14.6 By approving and submitting Shop Drawings, Product Data, Samples and Manuals, the Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

Parts and details not fully indicated on the contract drawings shall be detailed by the Contractor in accordance with standard engineering practice. Dimensions on the drawings, as well as detailed drawings themselves, are subject in every case to measurements of existing, adjacent, incorporated and completed Work, which shall be taken by the Contractor before undertaking any Work dependent on such data.

- 4.14.7 The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Owner or A/E's approval of Shop Drawings, Product Data, Samples or Manuals under Article 2, Architect/Engineer unless the Contractor has specifically informed the Owner and A/E in writing of such deviation at the time of submission and the Owner has given specific written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data, Samples or Manuals by the A/E's approval thereof.
- 4.14.8 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Owner or A/E on previous submittals.

No portion of the Work requiring submission of Shop Drawings, Product Data, or Samples shall commence until the submittal has been approved by the Owner and A/E as provided in Article 2, Architect/Engineer. All such portions of the Work shall be in accordance with approved submittals.

- 4.14.9 For substances that are proposed for use in the Project that may be hazardous to human health, the Contractor shall submit to the A/E, for information only, information on precautions for safely using these substances, including Material Safety Data Sheets and certification of registration by the Contractor with authorities under the respective Virginia and Federal Toxic Substances Control Acts.
- 4.14.10 Unless otherwise modified by the Owner in writing, the Contractor shall label or stamp and number all Shop Drawings, Product Data, Samples or Manuals as prescribed by the Project Manager.
- 4.14.11 The Contractor shall submit a copy of each submittal, including the transmittal sheet (for shop drawings, product data, samples or manuals) to the Owner simultaneously with the Contractor's submission of said drawings, data, samples or manual packages to the A/E.

4.15 EQUAL PRODUCTS:

- 4.15.1 The term "Product" as used in the Contract Documents refers to materials, equipment, supplies, articles, fixtures, devices, types of construction, or products, as appropriate.
- 4.15.2 All products furnished shall, whenever specified and otherwise wherever practicable, be the standard products of recognized, reputable manufacturers. If the manufacturer cannot make scheduled delivery of an approved item, the Contractor may request approval of the A/E to use another brand, make, manufacturer, article, device, product, material, fixture, form or type of construction which the Contractor judges to be equal to that specified. An item need not be considered by the A/E for approval as equal to the item so named or described unless it (1) it is at least equal in quality, durability, appearance, strength, and design; (2) it will perform at least equally the specific function imposed by the general design for the work being contracted for or the material being purchased; and (3) it conforms substantially, even with

deviations, to the detailed requirements for the item in the specifications. Approval shall be at the sole discretion of the A/E and will be based upon considerations of quality, workmanship, economy of operation, suitability for the purpose intended, and acceptability for use on the project. Any such approval must be in writing to be effective, and the decision of the A/E shall be final.

4.15.4 To obtain such approval of equal products other than those specified in Contract Documents, and not previously approved during the bidding, the Contractor's request for approval of any equal product shall include the following:

- .1 Complete data substantiating compliance of the proposed equal product with the Contract Documents;
- .2 Accurate cost data on proposed equal product in comparison with product or method specified;
- .3 Product identification including manufacturer's name, address, and phone number;
- .4 Manufacturer's literature showing complete product description, performance and test data, and all reference standards;
- .5 Samples and colors in the case of articles or products;
- .6 Name and address of similar projects on which the product was used and date of installation;
- .7 All directions, specifications, and recommendations by manufacturers for installation, handling, storing, adjustment, and operation.

4.15.5 The Contractor shall also submit with his request for approval a statement which shall include all of the following representations by the Contractor, namely that:

- .1 He has investigated the proposed equal product and determined that it is equal or better in all respects to that specified and that it fully complies with all requirements of the Contract Documents;
- .2 He will meet all contract obligations with regard to this substitution;
- .3 He will coordinate installation of accepted equal products into the work, making all such changes and any required schedule adjustments, at no additional cost to the Owner, as may be required for the Work to be complete in all respects;
- .4 He waives all claims for additional costs and additional time related to equal products. He also agrees to hold the Owner harmless from claims for extra costs and time incurred by subcontractors and suppliers, or additional services which may have to be performed by the A/E, for changes or extra work that may, at some later date, be determined to be necessary in order for the Work to function in the manner intended in the Contract Documents;
- .5 He will provide the same warranty and guarantee, and perform any work required in accordance therewith, for the equal product that is applicable to the specified item for which the equal product is requested;
- .6 Material will be installed, handled, stored, adjusted, tested, and operated in accordance with the manufacturers' recommendation and as specified in the Contract Documents;

- .7 In all cases, new materials will be used unless this provision is waived in writing by, the Owner or unless otherwise specified in the Contract Documents;
 - .8 All material and workmanship will be in every respect, in accordance with that which in the opinion of the Owner, is in conformity with approved modern practice; and
 - .9 He has provided accurate cost data on the proposed equal product in comparison with the product or method specified, if applicable.
- 4.15.6 The Owner may require tests of all products proposed as equal products so submitted to establish quality standards, at the Contractor's expense. After approval of an equal product, if it is determined that the Contractor submitted defective information or data regarding the equal product upon which Owner's approval was based, and that unexpected or unanticipated redesign or rework of the Project will be required in order to accommodate the equal product, or that the item will not perform or function as well as the specified item for which equal product was requested, the Contractor will be required to furnish the original specified item or request approval to use another equal product. The Contractor shall pay all costs, expenses or damages associated with or related to the unacceptability of such an equal product and the resultant utilization of another item, and no time extension shall be granted for any delays associated with or related to such an equal product.
- 4.15.7 Equal products will not be considered for approval by the Owner if:
- .1 The proposed equal product is indicated or implied on the Contractor's shop drawing or product data submittals and has not been formally submitted for approval by the Contractor in accordance with the above-stated requirements; or
 - .2 Acceptance of the proposed equal product will require substantial design revisions to the Contract Documents or is otherwise not acceptable to the Owner.
- 4.15.8 Except as otherwise provided for by the provisions of any applicable laws, the Contractor shall not have any right of appeal from the decision of the Owner disapproving any products submitted if the Contractor fails to obtain the approval for an equal product under this Article.
- 4.15.8 If the Contractor proposes a product which the Owner determines is not equal to the product named in Contract Documents but which the Owner nevertheless is willing to accept, Contractor shall provide, upon request by the Owner, an itemized comparison of the proposed substitution with the product specified and the cost differential which shall be credited to the Owner in a Change Order issued in accordance with Article 12, Changes and Modifications in the Work.

4.16 USE OF SITE

- 4.16.1 The Contractor shall confine his operations at the site to areas permitted by law, ordinances, permits, easements, right-of-way agreements and the Contract Documents. The Contractor shall not unreasonably encumber the site, in the opinion of the Owner, with any materials, equipment or trailers, nor shall Contractor block the entrances or otherwise prevent reasonable access to the site, other working and parking areas, completed portions of the Work and/or properties, storage areas, areas of other facilities that are adjacent to the worksite. If the Contractor fails or refuses to move said material, equipment or trailers within 24 hours of Notice by the Owner to so do, the Owner shall have the right, without further Notice, to remove, at the Contractor's expense, any material, equipment and/or trailers which the Owner deems are in violation of this paragraph.

4.17 CUTTING AND PATCHING OF WORK

- 4.17.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work and to make its several parts fit properly and in accordance with the Contract Documents.
- 4.17.2 The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any separate contractors by cutting, patching or otherwise altering any work; or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor shall not unreasonably withhold from the Owner or any separate contractor Contractor's consent to cutting or otherwise altering the Work. The Owner shall not be required to accept Work with a cut, splice, or patch when such cut, splice or patch is not generally accepted practice for the particular work involved or is otherwise unworkmanlike in the opinion of the Owner.

4.18 SITE CLEAN UP

- 4.18.1 The Contractor at all times shall keep the Project site and adjacent areas free from accumulation of waste materials or rubbish caused by his operations. Before final payment is made, the Contractor shall remove all of his waste materials, rubbish, scrap materials, debris, tools, construction equipment, machinery, surplus materials, falsework, temporary structures, including foundations thereof and plant of any description, from the Project site and put the site in a neat, orderly condition.
- 4.18.2 If the Contractor fails to clean up as required herein at any time during the performance of the Work or at the completion of the Work, the Owner may, upon 24 hours notification, clean up the site at the Contractor's expense.

4.19 PATENTS, ROYALTIES, ETC.

- 4.19.1 The Contractor guarantees to save harmless the Owner, its officers, agents, servants and employees from liability of any kind or nature, including without limitation, cost, expense and attorney's fees, on account of suits and claims of any kind for violation or infringement of any patents or patent rights by the Contractor, or by anyone directly or indirectly employed by him, or by reason of the use of any art, process, method, machine, manufacture, or composition of matter patented or unpatented in the performance of this Contract in violation or infringement of any letter or rights. The Contractor agrees to pay all royalties, fees, licenses, etc. required in respect of the Work or any part thereof as part of his obligations hereunder without any additional compensation.

4.20 INDEMNIFICATION

- 4.20.1 It is hereby mutually covenanted and agreed that the relation of the Contractor to the Work to be performed by him under this Contract shall be that of an independent contractor and that as such he will be responsible for all damages, loss or injury, including death, to persons or property that may arise or be incurred in or during the conduct and progress of said work as the result of any action, omission or operation under the Contract or in connection with the Work, whether such action, omission or operation is attributable to the Contractor, subcontractor, any material supplier, or anyone directly or indirectly employed by any of them. The Contractor shall make good any damages that may occur in consequence of the Work or any part of it. The Contractor shall assume all liability, loss and responsibility of whatsoever nature by reason of his neglect or violation of any federal, state, county or local laws, regulations, codes or ordinances.
- 4.20.2 The Contractor shall indemnify, hold harmless and defend the Owner, its employees, agents, servants and representatives from and against any and all claims, suits, demands, actions (regardless of the merits thereof) and damages of whatever nature arising out of or resulting from the performance of the Work or

the failure to perform the Work, including without limitation, jurisdictional labor disputes or other labor troubles that may occur during the performance of the Work.

- 4.20.3 The indemnification obligations under this Article shall not be affected in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under worker's or workman's compensation acts, disability benefit acts or other employee benefit acts.
- 4.20.4 The obligations of the Contractor under this Article 4.20 shall not extend to the actions or omissions of the A/E, his agents or employees, arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications.
- 4.20.5 The obligations of the Contractor under this Article 4.20 shall not extend to the proportion of damages, loss or injury, including death, to persons or property that may arise or be incurred as the result of any action, omission or operation of the Owner, or Owner's separate contractor(s), and their employees, agents, servants, and/or representatives.

4.21 NON-DISCRIMINATION IN EMPLOYMENT

4.21.1 During the performance of this Contract, the Contractor agrees as follows:

- .1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
- .2 The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.
- .3 Notices, advertisements and solicitations placed in accordance with federal law, Rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
- .4 The Contractor will include the provisions of the foregoing paragraphs 1, 2, and 3 in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

4.21.2 DRUG-FREE WORKPLACE REQUIRED:

As required by section 2.2-4312 of the Code of Virginia during the performance of the Contract, Contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this Article 4.21, "drug-free workplace" means a site for the performance of Work done in connection with this Contract where Contractor's employees are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during

the performance of the Contract.

4.22 CONTRACT SECURITY

- 4.22.1 The Contractor shall deliver to the Owner, within ten (10) working days from Notice of Award, two (2) originals of a Performance Bond and a separate Labor and Material Payment Bond, in a form acceptable to the Owner, and each in an amount required by the Contract Documents and the Virginia Public Procurement Act, as security for the faithful performance of the Contract, and the payment of all persons performing labor and furnishing materials in connection with this Contract. The City will not issue Notice to Proceed until the bonds are received. The amount of the Performance and Payment Bonds shall be increased to the same extent the Contract Sum is increased due to Modifications. The form of bonds shall be acceptable to the Owner, and the surety shall be such surety company or companies as are acceptable to the Owner and as are authorized to transact business in the Commonwealth of Virginia. The cost of such bonds shall be included in the Contractor's bid amount.
- 4.22.2 The bonds shall irrevocably obligate the Contractor and surety to the full amount of the bonds unless and until all of Contractor's obligations under the Contract Documents have fully been fulfilled.
- 4.22.3 If, at any time, any surety or sureties for any bond relating to the Work becomes insolvent or is determined by the Owner to be unable to adequately secure the interest of the Owner, the Contractor shall, within (30) days after Notice from the Owner to do so, substitute an acceptable bond(s) in such form and sum and with such other sureties as obligors as may be satisfactory to the Owner. The premiums on such bond(s) shall be paid by the Contractor.

ARTICLE 5 SUBCONTRACTORS

5.1 DEFINITIONS

- 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform or supply any of the Work at the site. Subcontractor means a Subcontractor or his authorized representative. The term Subcontractor does not include any separate contractor performing work pursuant to Article 6 or his subcontractors.
- 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform or supply any of the Work at the site. The term Sub-subcontractor includes a Sub-subcontractor or an authorized representative thereof.
- 5.1.3 The A/E will not deal directly with any Subcontractor or Sub-subcontractor or materials supplier. Subcontractor, Sub-subcontractors or material suppliers shall route requests for information or clarification through the Contractor to the A/E, with a copy to the Owner.

5.2 AWARD OF SUBCONTRACT AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

- 5.2.1 The Contractor shall submit to the Owner with a copy to the A/E prior to the award of any subcontract for Work under this Contract and thirty (30) calendar days after the award of this Contract, the names of the suppliers of principal items, systems, materials, and equipment proposed for the Work; the names and addresses, business and emergency phones of the Subcontractors which he proposes to employ under this Contract, as well as such other information as may be requested by the Owner. The Owner will review each Subcontractor and supplier based upon his apparent financial soundness and responsibility, his known or reported performance on previous similar work, and his available plant, equipment and personnel to perform the Work. The Contractor shall not employ a Subcontractor or supplier to whom the Owner reasonably objects. The Owner's objection to a proposed Subcontractor or supplier shall not affect the Contract Sum.

5.2.2 The Contractor shall make no substitutions for any Subcontractor, person or entity previously selected unless first submitted to the Owner for review and approval.

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 By an appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Contract Documents, assumes toward the Owner and the A/E. Said agreement shall preserve and protect the rights of the Owner and the A/E under the Contract Documents with respect to the Work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Contractor-Subcontractor agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contracts Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with his Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract, copies of all of the Contract Documents, and identify to the Subcontractor any terms and conditions of the proposed subcontract which may be at variance with the Contract Documents. Each Subcontractor shall similarly make copies of such Contract Documents available to his Sub-subcontractor's. Each subcontract agreement shall insure that all appropriate provisions of the Contract Documents are complied with by the Subcontractor.

5.3.2 The provisions herein regarding the City's reasonable objection to any Subcontractor shall in no way affect the liability of the Contractor to Owner regarding performance of all obligations by or payment of Subcontractors. The City's failure to object to any given Subcontractor shall not relieve the Contractor of his obligation to perform or have performed to the full satisfaction of the Owner all of the work required by this Contract.

5.3.3 Neither this article nor any other provision of the Contract Documents shall be deemed to make the Owner a joint venture or partner with the Contractor or to place the Subcontractor and materialmen in privity of contract with the Owner.

5.4 QUALIFICATION SUBMITTALS

5.4.1 Specific qualification submittals may be required of the Contractor, Subcontractors, installers and suppliers for certain critical items of the Work. Required qualification submittals are set forth in detail in the Instruction to Bidders and shall be provided, collected and submitted by the Contractor to the A/E with copies to the Owner. All information required of a single Subcontractor, installer or supplier shall be contained in a single, complete submittal. The Contractor shall submit the required qualification information within ten (10) days after receipt of the Owner's request.

5.4.2 The Owner may reject any proposed Subcontractor, installer or supplier, or any qualification submittals related thereto, for the following reasons:

- .1 The Contractor's failure to submit requested information within the specified time; or
- .2 The Contractor's failure to provide all of the requested information; or
- .3 The Contractor's submission of a Subcontractor, installer or supplier, or qualifications thereof, which are unacceptable in the judgment of the Owner.

5.4.3 Should the Owner have reasonable objection to any proposed Subcontractor, installer or supplier, the Contractor shall submit another firm for approval by the Owner at no additional cost to the Owner.

ARTICLE 6

WORK BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM WORK AND TO AWARD SEPARATE CONTRACTS

- 6.1.1 The Owner reserves the right to perform work related to the Project with his own forces, and to award separate contracts in connection with other portions of the Project or other work on the site.
- 6.1.2 When separate contracts are awarded for different portions of the Project or other work on the site, the term "contractor" in the contract documents in each case shall mean the contractor who executes each separate construction agreement.

6.2 MUTUAL RESPONSIBILITY

- 6.2.1 The Contractor shall afford other contractors and the Owner reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work and shall properly connect and coordinate the Work with such other work. The Contractor shall coordinate his Work with the Owner and other contractors and store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the Work as will not unduly interfere with the progress of the Work or the work of any other contractors.
 - 6.2.1.1 If the execution or result of any part of the Work depends upon any work of the Owner or of any separate contractor, the Contractor shall, prior to proceeding with the Work, inspect and promptly report to the Owner in writing any apparent discrepancies or defects in such work of the Owner or of any separate contractor that render it unsuitable for the proper execution or result of any part of the Work.
 - 6.2.1.2 Failure of the Contractor to so inspect and report shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive the Work, except as to defects which may develop in the Owner's or separate contractor's work after completion of the Work and which the Contractor could not have discovered by its inspection prior to completion of the Work.
- 6.2.2 Should the Contractor cause damage to the work or property of the Owner or of any separate contractor on the Project, or to other work on the site, or delay or interfere with the Owner's work on ongoing operations or facilities or adjacent facilities or said separate contractor's work, the Contractor shall be liable for the same; and, in the case of another contractor, the Contractor shall attempt to settle said claim with such other contractor prior to such other contractor's institution of litigation or other proceedings against the Contractor.

If such separate contractor sues the Owner on account of any damage, delay or interference caused or alleged to have been so caused by the Contractor, the Owner shall notify the Contractor, who shall defend the Owner in such proceedings at the Contractor's expense. If any judgment or award is entered against the Owner, the Contractor shall satisfy the same and shall reimburse the Owner for all damages, expenses, and other costs that the Owner incurs as a result thereof.

- 6.2.3 Should Contractor have a dispute with a separate contractor with whom the Owner has contracted regarding damage to the Work or the property of Contractor or to the Work or property of said separate contractor or with regard to any delays or interferences which either Contractor or said separate contractor has caused to the performance of the other's Work, Contractor agrees to attempt to settle such dispute directly with said separate contractor. Contractor agrees that it will not seek to recover from the Owner any damages, costs, expenses (including, but not limited to, attorney's fees) or losses of profit incurred by the Contractor as a result of any damage to the Work or property of the Contractor or for any delay or interference caused or allegedly caused by any separate contractor.

6.3 OWNER'S RIGHT TO CLEAN UP

- 6.3.1 If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up as required by Article 4, Contractor, the Owner may clean up and charge the cost thereof to the contractor responsible as the Owner shall determine to be just.

ARTICLE 7 MISCELLANEOUS PROVISIONS

7.1 GOVERNING LAW

The provisions of this Contract shall be interpreted in accordance with the laws of the Commonwealth of Virginia.

7.2 PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein and if through mistake or otherwise, any such provision is not inserted or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

7.3 SUCCESSORS AND ASSIGNS

The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or sublet it without the written consent of the other, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner and the Contractor's surety.

In the event the Contractor desires to make an assignment of all or part of the Contract or any monies due or to become due hereunder, the Contractor shall file a copy of consent of surety, together with a copy of the assignment to the Owner and A/E. In the event the Contractor assigns all or any part of the monies due or to become due under this Contract, the instrument of assignment shall state that the right of assignees in and to any monies due to or to become due to Contractor shall be subject to prior liens and claims of all persons, firms and corporations that provided labor services or furnished material and equipment during the performance of the Work. The rights of assignees shall further be subject to the payment of any liens, claims, or amounts due to Federal, state, or local governments.

7.4 RIGHTS AND REMEDIES

- 7.4.1 The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law, not inconsistent with the Contract Documents. No time limitations described in this Contract shall be construed to alter the applicable statutory period of limitations with regard to the enforcement of the obligations of the parties.
- 7.4.2 No action or failure to act by the Owner, A/E or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.
- 7.4.3 Contractor agrees that he can be adequately compensated by money damages for any breach of this Contract which may be committed by the Owner and hereby agrees that, no default, act, or omission of

the Owner or the A/E, except for failure to make payments as required by the Contract Documents, shall constitute a material breach of the Contract entitling Contractor to cancel or rescind the provisions of this Contract or (unless the Owner shall so consent or direct in writing) to suspend or abandon performance of all or any part of the Work. Contractor hereby waives any and all rights and remedies to which he might otherwise be or become entitled, saving only its right to money damages.

7.5 SEVERABILITY

In the event that any provision of this Contract shall be adjudged or decreed to be invalid, such ruling shall not invalidate the entire agreement but shall pertain only to the provision in question and the remaining provisions shall continue to be valid, binding, and in full force and effect.

7.6 TESTS

- 7.6.1 If the Contract Documents, laws, ordinances, rules, regulations, codes, permits, resolutions or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Owner at least 24 hours notice of its readiness so that the Owner or the A/E or other representatives of the Owner may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, tests or approvals conducted by public authorities. Site inspections, tests conducted on site or tests of materials gathered on site, which the Contract requires to be performed by independent testing entities, shall be contracted and paid for by the Contractor. Examples include, but are not limited to, the testing of cast-in-place concrete, foundation materials, soil compaction, pile installations, caisson bearings, and steel framing connections.
- 7.6.2 All materials and workmanship (if not otherwise designated by the specifications) shall be subject to inspection, examination or test by the Owner, A/E, and other representatives of the Owner, at any and all times during the manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. Special, full-sized and performance tests shall be as described in the specifications. Without additional charge, the Contractor shall furnish promptly all reasonable facilities, labor and materials necessary to make tests safe and convenient.
- 7.6.3 The selection of bureaus, laboratories and/or agencies for the inspection and tests of supplies, materials or equipment shall be subject to the approval of the Owner. Satisfactory documentary evidence, including but not limited to certificates of inspection and certified test reports that the material has passed the required inspection and tests must be furnished to the Owner, with a copy to the A/E, by the Contractor prior to the incorporation of the supplies, materials or equipment into the Work or at such times as to allow for appropriate action by the Owner.
- 7.6.4 Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor. Tests required by Contractor's or Subcontractor's error, omission or non-compliance with the Contract Documents, shall be paid for by the Contractor.
- 7.6.5 It is specifically understood and agreed that an inspection and approval of the materials by the Owner shall not in any way subject the Owner to pay for the said materials or any portion thereof, even though incorporated in the Work, if said materials shall in fact turn out to be unfit to be used in the Work, nor shall such inspection be considered as any waiver of objection to the Work on account of the unsoundness or imperfection of the material used.

ARTICLE 8 CONTRACT TIME

8.1 DEFINITION

8.1.1 Unless otherwise provided, the Contract Time is the period of time specified in the Contract Documents for Substantial Completion of the Work as defined herein, including authorized adjustments thereto. The Contractor shall complete his Work within the Contract Time.

8.1.2 The date of commencement of the Work is the date established in the Notice to Proceed

The Contractor shall not commence Work or store materials or equipment on site until written Notice to Proceed is issued or until the Contractor otherwise receives the Owner's written consent. The Contractor shall commence work no later than ten (10) days after the date established in the Notice to Proceed.

8.1.3 The date of Substantial Completion of the Work or designated portion thereof is the date determined by Owner when: (1) construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for the use for which it is intended; and (2) the Contractor has satisfied all other requirements for Substantial Completion which may be set forth in the Contract Documents.

8.1.4 The date of Final Completion of the Work is the date determined by the Owner when the Work is totally complete, to include punch list work, in accordance with the Contract Documents and the Owner may fully occupy and utilize the Work for the use for which it is intended.

8.1.5 The term "day" as used in the Contract Documents shall mean calendar days unless otherwise specifically designated.

8.2 PROGRESS AND COMPLETION

8.2.1 All time limits stated in the Contract Documents, including without limitation the date of Substantial Completion of the Work, are of the essence of the Contract.

8.2.2 The Contractor shall begin the Work on the date of commencement as defined herein. He shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial and Final Completion as required by the Contract Documents.

8.3 CLAIMS FOR TIME EXTENSIONS

8.3.1 The time during which the Contractor is delayed in the performance of the Work by the acts or omissions of the Owner, the A/E or their employees or agents, acts of God, unusually severe and abnormal climatic conditions, fires, floods, epidemics, quarantine restrictions, strikes, riots, civil commotion or freight embargoes, or other conditions beyond the Contractor's control and which the Contractor could not reasonably have foreseen and provided against, shall be added to the time for completion of the Work (i.e., the Contract Time) stated in the Agreement; however, no claim by the Contractor for an extension of time for delays will be considered unless made in compliance with the requirements of this Article and other provisions of the Contract Documents.

8.3.2 The Owner shall not be obligated or liable to the Contractor for, and the Contractor hereby expressly waives any claims against the Owner on account of, any indirect or direct damages, costs or expenses of any nature which the Contractor, its Subcontractors, or Sub-subcontractor's or any other person may incur as a result of (1) any delays, reasonable or unreasonable, foreseeable or unforeseeable, which are either not caused by the acts or omissions of the Owner, its agents or employees or which arise from or out of (or due to) causes not within the control of the Owner, its agents or employees, or (2) any reasonable

delay regardless of its cause, it being understood and agreed that the Contractor's sole and exclusive remedy in any such events shall be an extension of the Contract Time, but only as determined in accordance with the provisions of the Contract Documents.

- 8.3.3 The burden of proof to substantiate a claim for an extension of the Contract Time shall rest with the Contractor, including evidence that the cause was beyond his control. It shall be deemed that the Contractor has control over the supply of labor, materials, equipment, methods and techniques of construction and over the Subcontractors, Sub-contractors, and suppliers, unless otherwise specified in the Contract Documents.
- 8.3.4 In the event of changes in the Work, the Contractor must identify any additional time required in the Proposed Change Order. The Owner need not consider any time extensions for changes in the Work not included in the Proposed Change Order.
- 8.3.5 No time extensions will be granted as a result of the Contractor's improper or unreasonable scheduling or for the Contractor's failure to have Shop Drawings, Product Data, Samples or Manuals submitted in ample time for review under a reasonable and agreed upon schedule.
- 8.3.6 Delays by Subcontractors, Sub-subcontractors or suppliers will not be considered justification for a time extension, except for the same valid reasons and conditions enumerated herein.
- 8.3.7 The Contractor acknowledges and agrees that actual delays due to changes, suspension of work or excusable delays; in activities which, according to the Construction Schedule, do not affect the Contract Time will not be considered to have any effect upon the Contract Time and therefore will not be the basis for a time extension.
- 8.3.8 The Contractor acknowledges and agrees that time extensions will be granted only to the extent that: (1) excusable delays exceed the available flexibility in the Contractor's schedule; and (2) Contractor can demonstrate that such excusable delay actually caused, or will cause, delay to the Contractor's schedule that will extend the Contract Time.
- 8.3.9 With respect to Suspensions of Work under Paragraph 3.6, Suspension of Work, herein, the Contractor shall be entitled to an extension of the Contract Time not to exceed the length of time that the Work was suspended (unless as determined under this Article and the other requirements of the Contract Documents that a further extension is justified and warranted) if the claim is submitted in accordance with the requirements of this Article, and if the suspension is not due to any act or omission of the Contractor, any Subcontractor or Sub-subcontractor or any other person or organization for whose acts or omission the Contractor may be liable. The Contractor's claim will be evaluated in accordance with the terms of this Article.
- 8.3.10 The Contractor shall not be entitled to any extension of time for delays resulting from any conditions or other causes unless it shall have given written Notice to the Owner, within seven (7) calendar days following the commencement of each such condition or cause, describing the occurrence, the activities impacted and the probable duration of the delay. The Contractor's complete claim submittal for a time extension shall be submitted no later than twenty (20) calendar days after cessation of the delay or within such other longer period as the Owner may agree in writing to allow.
- 8.3.11 No such extension of time shall be deemed a waiver by the Owner of his right to terminate the Contract for abandonment or delay by the Contractor as herein provided or to relieve the Contractor from full responsibility for performance of his obligations hereunder.

8.4 CHANGE ORDER WORK

- 8.4.1 The Contractor shall make every reasonable effort to perform Change Order work within the Contract Time and in such manner as to have minimum delaying effects on all remaining Work to be performed under the Contract. If, however, the Change Order work results in an unavoidable increase in the time required to complete the Work, an extension of the Contract Time may be granted to the Contractor for the Change Order work. The Contractor's request shall be determined in accordance with the provisions of Article 8.3, Claims for Time Extensions, herein and as follows:
- .1 If the time required for performance of the Change Order work has an unavoidable, direct, delaying effect on the primary sequence of Work activities remaining after rescheduling (e.g., the critical path in CPM type scheduling), the overall Contract Time may be extended by the minimum number of days required for the Change Order work as mutually agreed upon by the Owner and the Contractor;
 - .2 If the time required for performance of the Change Order work does not have an unavoidable direct delaying effect on the primary sequence of Work activities but is ordered by the Owner at a time such that insufficient Contract Time remains for completion of the Change Order work (and any limited number of contingent work activities), the Contract Time may be extended by the minimum number of days required for the Change Order work as mutually agreed upon by the Owner and the Contractor but only for the Change Order work and contingent activities, All other unaffected Work shall be performed within the Contract Time;
 - .3 Failure of the Owner and the Contractor to agree on a Contract Time extension as specified in .1 and .2 above shall not relieve the Contractor from proceeding with and performing the Change Order work promptly, as well as in such manner as to have minimal delaying effects on all remaining Work to be performed under the Contract. Such disagreement shall be resolved as soon as practical by negotiation.

8.5 LIQUIDATED DAMAGES FOR DELAY

- 8.5.1 The damages incurred by the Owner due to the Contractor's failure to complete the Work within required Milestone Dates and the Contract Time, including any extensions thereof, shall be in the amount set forth in the Construction Agreement, for each consecutive day beyond the Milestone Dates or the Contract Time (Sundays and all holidays included) for which the Contractor shall fail to complete the Work.
- 8.5.2 The parties hereby agree that the amount of liquidated damages provided in this Contract is neither a penalty nor a forfeiture and is intended to compensate the Owner solely for the Owner's inability to use the Work for its fully intended purpose, and is not intended to, nor does said amount include: (1) any damages, additional or extended costs; incurred by the Owner for extended administration of this Contract, or by the Owner's agents, consultants or independent contractors for extended administration of this Contract, or (2) any additional services, relating to or arising as a result of the delay in the completion of the Work. Owner shall be entitled to claim against Contractor for its actual damages ~~and~~ for any damages not specifically included within the liquidated damages as set forth herein. Such damages shall be computed separately, and, together with liquidated damages, either deducted from the Contract Sum or billed to the Contractor, at the option of the Owner.

Contractor agrees that it will not challenge the per diem amounts of liquidated damages imposed pursuant to this Article 8.5 except as to whether Contractor is responsible for the delays, themselves, that have resulted in the assessment of liquidated damages. The Contractor waives any challenge as to the validity of any liquidated damages specified on the grounds that such liquidated damages allegedly are void as penalties or allegedly are not reasonably related to Owner's actual damages.

Owner may, in its sole discretion, deduct from any payments otherwise due Contractor amounts of liquidated damages assessable under this Article 8.5. Owner's failure to deduct liquidated damages assessable under this Article 8.5 from payments to Contractor shall not be deemed a waiver by Owner of any entitlement to such liquidated damages.

8.6 TIME EXTENSIONS FOR WEATHER

8.6.1 The Contract Time will not be extended due to inclement weather conditions that are normal to the general locality of Work site. The time for performance of this Contract includes an allowance for workdays (based on a 5-day workweek) which, according to historical data, may not be suitable for construction work.

- .1 The following is the schedule of monthly anticipated normal inclement weather workdays for the Project location and will constitute the base line for monthly weather time extension evaluations.

ANTICIPATED NORMAL INCLEMENT WEATHER WORK-DAYS INCLUDED IN THE CONTRACT TIME OF PERFORMANCE											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7	7	7	7	9	7	7	7	6	6	6	7

8.6.2 The Contractor, in his planning and scheduling of the Work as required by the Contract Documents, shall allow for the normal inclement weather for the locality of the Work site. If the Contractor believes that the progress of the Work has been adversely affected and that it will directly result in a failure to meet Substantial Completion within the Contract Time, by weather conditions above and beyond the amount normally expected, he shall submit a written request to the Owner, with a copy to the A/E, for an extension of time, pursuant to Paragraph 8.3, Claims for Time Extensions.

8.6.3 Such request shall be evaluated by the Owner in accordance with the provisions of the Contract Documents and shall include a comparison of actual weather statistics compiled by City of Lynchburg's Department of Public Works, for the time of year, locality of the particular Work site with the days claimed by the Contractor and the anticipated normal inclement weather as stated in subparagraph 8.6.1. The normal inclement weather expected has been included in the designated Contract Time for completion. The decision of the Owner shall be final.

8.6.4 The Contractor shall not be entitled to any money damages whatsoever for any delays resulting from inclement weather, whether normal or abnormal, foreseeable or unforeseeable. The Contractor and Owner stipulate and agree that, for delays due to weather as determined in 8.6.3, the Contractor's sole relief is a time extension granted in accordance with this Article 8.6, Time Extensions for Weather.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contract Sum is stated in the Construction Agreement and, including authorized adjustments thereto, is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents. The Contract Sum includes, but is not limited to, the Contractor's profit and general overhead and all costs and expenses of any nature whatsoever (including without limitation taxes, labor, equipment and materials), foreseen or unforeseen, and any increases in said costs and expenses, foreseen or unforeseen, incurred by the Contractor in connection with the performance of the Work, all of which

costs and expenses shall be borne solely by the Contractor. The Contractor agrees to assume all increases in costs of any nature whatsoever that may develop during the performance of the Work.

9.2 SCHEDULE OF VALUES

- 9.2.1 For Lump Sum Price contracts, before the pre-construction meeting, the Contractor shall submit to the Owner and A/E a schedule of values allocated to the various portions of the Work, prepared on payment forms provided by the Owner and supported by such data to substantiate its accuracy as the Owner may require. This schedule of values, unless rejected by the Owner, shall be used as a basis for the Contractor's Applications for Payment.
- 9.2.2 For Unit Price contracts, the Contractor shall utilize the payment request form provided by the Owner, wherein the schedule of values shall correspond with the individual unit price bid items. When so requested by the Owner, the Contractor shall provide a more detailed cost breakdown of the unit price items.
- 9.2.3 Contractor may include in his schedule of values a line item for "mobilization" which shall include a reasonable amount for mobilization for the Contractor and his Subcontractors. The Contractor shall not front-end load his schedule of values.

9.3 APPLICATION FOR PAYMENT

- 9.3.1 The Contractor shall submit to the A/E three (3) originally executed, itemized Applications for Payment (and one (1) copy to the Owner) by the tenth of each month, along with any authorized change orders for that billing cycle. The Applications for Payment shall be notarized, indicate in complete detail all labor and material incorporated in the Work during the month prior to submission, and supported by such data substantiating the Contractor's payment request as the Owner may require. The Applications for Payment shall also contain Contractor's certification that due and payable amounts and bills have been paid by the Contractor for Work for which previous Certificates of Payment were issued and payments received from the Owner.
- 9.3.2 Payment may be made for the value of materials, which are to be incorporated into the finished Work, and which are delivered to and suitably stored and protected on the Work site. The Contractor shall provide releases or paid invoices from the seller of such materials to establish, to the Owner's satisfaction, that the Owner has title to said material. Stored materials shall be in addition to the Work completed and shall be subject to the same retainage provisions as the completed Work. Material once paid for by the Owner becomes the property of the Owner and may not be removed from the Work site without the Owner's written permission.
- 9.3.3 The requirements for payment for materials stored off-site shall include, but are not limited to, those specified in Paragraph 9.3.2 and the additional requirements hereinafter specified. Material stored off-site under this provision shall be included in the definition of Work, Article 1, Contract Documents.
 - 9.3.3.1 The requirements of Paragraph 10.2, Safety of Persons and Property, are fully applicable to materials stored off-site.
 - 9.3.3.2 For purposes of administering this provision, the following definitions are provided.
 - a. Material stored NEAR the Work site: A storage location shall be considered near the Work site if it is not more than fifty (50) miles (approximately a one-hours drive) from the Work site.

b. Material stored DISTANT from the Work site: Locations beyond the limit of fifty (50) miles shall be considered distant.

- 9.3.3.3 All proposed off-site locations, regardless of whether they are near or distant, shall be approved by the Owner prior to any payment under this Article. The approval process will include an inspection of the proposed storage site, which may or may not coincide with any inspection of materials stored.
- 9.3.3.4 Prior to payment for any material stored off-site, said material shall be inspected to verify that it is properly stored; i.e., segregated, inventoried, identified as the property of the Owner and Contractor, and duly protected as required in Article 10.2, Safety of Persons and Property. This material shall be clearly identified and physically segregated from any other material or stock, in such a manner that it is clear, from casual observation that said material is not a part of any other stock or stored material.
- 9.3.3.5 For materials stored distant to the Work site, the Contractor shall reimburse the Owner for all reasonable costs incurred by the Owner, to include but not limited to salary, transportation, lodging and per diem, for the Owner's or the A/E's employees to travel to and from the storage locations for the purpose of verifying that the material is properly stored. It is anticipated that such trips would occur whenever additional material is claimed for payment and/or at least every six (6) months until the material is delivered to the Work site.
- 9.3.3.6 Except for unusual circumstances, the Contractor will not be required to reimburse the Owner's costs for visits to storage locations near the Work site.
- 9.3.3.7 The Contractor shall hold the Owner harmless from any and all losses, additional costs, direct or indirect damages and/or delays, whatsoever, which may occur as a result of a failure of the Contractor to deliver (or have delivered), in a timely manner, materials (for which payment has been made) to the Work site for installation and incorporation into the Work.
- 9.3.3.8 The Contractor shall provide to the Owner a release of lien or other suitable certification by the seller of the materials, in addition to paid invoices, verifying that the Contractor has valid title to all materials for which payment is requested. The seller, however, shall not be required to waive his rights for recovery against Contractor or any surety if his contract is breached.
- 9.3.4 The Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the Owner, either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to as "liens". The Contractor further warrants that no Work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor or by any other person performing Work at the site or furnishing materials and equipment for the Work that is subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.
- 9.3.5 The Contractor's Application for Payment shall provide that the payment request attests that all Work for which the request is made has been completed in full according to all the requirements of the Contract Documents. By submitting his Application for Payment, the Contractor also represents that he has no knowledge that any Subcontractors or suppliers have not been fully and timely paid and that, insofar as he knows, the only outstanding items for payment with respect to the Contract are those to be paid from the funds for which application is being made.

9.4 CERTIFICATES FOR PAYMENT

- 9.4.1 The A/E will, within seven (7) calendar days after the receipt of the Contractor's Application for Payment, recommend a Certificate for Payment to the Owner, for such amount as the A/E determines is properly

due, with his reasons for any withholding or adjusting a Certificate as provided in Paragraph 9.6, Payments Withheld.

- 9.4.2 After the Certificate for Payment is recommended by the A/E, the Owner will review it and make any changes deemed necessary by the Owner's representative. The recommendation of the Certificate for Payment by the A/E does not waive or limit the Owner's right to reduce the amount of the payment due to the Contractor as determined to be appropriate by the Owner.
- 9.4.3 The recommendation of a Certificate for Payment will constitute a representation by the A/E to the Owner, based on his observations at the site as provided in Article 2, Architect/Engineer, and the data comprising the Application for Payment, that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief: (1) the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial or Final Completion, to the results of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in his Certificate); and that (2) the Contractor is entitled to payment in the amount certified. However, by recommending a Certificate for Payment, the A/E shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract Sum.
- 9.4.3.1.1 The Application for Payment shall be on a form approved by the City. Payment for stored material delivered but not incorporated in the work will be the invoiced amount only. Stored materials drawdown shall be approved by the Owner. Submit applicable invoices with Application for Payment. Monthly partial payment request shall be submitted in **TRIPLICATE** to Owner's representative for approval by the 25th of the month so that the Owner can approve payment request by the first working day of the next month. Partial payments shall be made on a monthly basis on or before the end of the next month for which the Work was performed, in accordance with the Contract Documents.
- 9.4.3.1.2 The Owner shall pay to the Contractor 95 percent of the total amount due and the Owner shall retain five (5) percent of the amount due until all work has been performed strictly in accordance with the Contract Documents and until such work has been accepted by the Owner.
- 9.5.1 The Owner shall make payment in the manner and within thirty (30) calendar days after receipt of the Certificate of Payment from the A/E based upon the Owner's approval or adjustment of said Certificate. The Contractor shall be paid the amount approved or adjusted by the Owner, less 5% retainage which is being held to assure faithful performance; provided however, that said retainage is not applicable to Time and Material Change Orders.
- 9.5.1.1 In relation to punch list or other uncompleted Work and in lieu of a portion of the above-specified five-percent 5% retainage, the Owner may, at its sole discretion, elect to retain fixed amounts directly relating to the various items of uncompleted Work. All amounts withheld shall be included in the Final Payment.
- 9.5.2 The Contractor shall, within seven (7) days after receiving payment from the Owner, do one of the following:
- 9.5.2.1 Pay all Subcontractors for the proportionate share of the total payment received from the Owner for Work performed by each Subcontractor under the Contract; or

- 9.5.2.2 Notify the Owner and Subcontractor(s), in writing, of his intention to withhold all or part of the Subcontractor's payment with the reason for nonpayment.
- 9.5.3 The Contractor shall make payment to Subcontractors as heretofore specified. Each payment shall reflect the percentage actually retained, if any, from payments to the Contractor on account of such Subcontractor's Work.
- 9.5.4 The Contractor shall provide the Owner with his social security number, if an individual, or his federal identification number, if a corporation, partnership, or other entity.
- 9.5.5 The Contractor shall pay unpaid Subcontractors interest on payments that are not made in accordance with this Article 9.5, Progress Payments. The rate of interest shall be in compliance with the Prompt Payment section of the Virginia Public Procurement Act of the Code of Virginia. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payments to his Sub-subcontractors according to all the same requirements as provided in this Article 9.5 Progress Payments.
- 9.5.6 The Owner may, upon written request, furnish to any Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Owner on account of Work done by such Subcontractor.
- 9.5.7 Neither the Owner nor the A/E shall have any obligation to pay or to see to the payment of any monies to any Subcontractor except as may otherwise be required by law.
- 9.5.8 No Certificate for Payment, nor any payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of any Work not in accordance with the Contract Documents, nor shall it waive any right or claim by Owner based upon the Work, or any portion of the Work, including Work for which payment has been made, not conforming to the requirements of the Contract Documents.

9.6 PAYMENTS WITHHELD

- 9.6.1 The Owner may withhold the payment in whole or in part, if necessary to reasonably protect the Owner. If the A/E is unable to make representations as provided in subparagraph 9.4.3 and to recommend payment in the amount of the application, he will notify the Owner as provided in subparagraph 9.4.1. If the Contractor and the Owner cannot agree on a revised amount, the Owner will promptly issue a Certificate for Payment for the amount for which he is able to make representations with respect to payment, due for Work performed. The Owner may also decline to certify or make payment because of subsequently discovered evidence or subsequent observations, and the Owner may nullify the whole or any part of any Certificate for Payment previously issued.
- 9.6.2 The Owner may withhold from the Contractor so much of any payment approved by the A/E, as may in the judgment of the Owner be necessary:
- .1 To protect the Owner from loss due to defective work not remedied;
 - .2 To protect the Owner upon receipt of notice of the filing in court or in an arbitration proceeding as may be required in any third party contract, of verified claims of any persons supplying labor or materials for the Work, or other verified third party claims;
 - .3 To protect the Owner upon reasonable evidence that the Work will not be completed for the unpaid balance of the Contract Sum;

- .4 To protect the Owner upon reasonable evidence that the Work will not be completed within the Contract Time established by this Contract; or
- .5 To protect the Owner upon the Contractor's failure to properly schedule and coordinate the Work in accordance with or as required by the Contract Documents, or failure to provide progress charts, revisions, updates or other scheduling data as required by the Contract Documents, or upon the Contractor's failure to provide as-built drawings as required herein, or upon Contractor's failure to otherwise substantially or materially comply with the Contract Documents.

9.6.3 If required by the Contract Documents, the Contractor shall, concurrent with his submission of the Construction Schedule, submit a practicable and realistic payment schedule showing the dates on which the Contractor will submit each and every Application for Payment and the amount he expects to receive for each and every monthly progress payment. If during the performance of the Work, the Contractor expects to receive an amount for a monthly progress payment larger than that indicated on the payment schedule, the Contractor shall notify the Owner at least thirty (30) days in advance of that payment so that the necessary allocation of funds can be processed. If Contractor fails to submit a practicable and realistic payment schedule, the Contractor's Application for Payment shall be honored only to the extent that the Work is actually performed and that the proportion of payments made to the Contract Sum does not exceed the proportion of the Contract Time expired as of the time of the request.

9.7 FAILURE OF PAYMENT

If the Owner does not make payment to the Contractor within the thirty (30) calendar days after receipt of the Contractor's Application for Payment by the A/E through no fault of Contractor, and the Owner otherwise not being entitled under the Contract Documents or applicable law to withhold payment, then the Contractor may, upon fifteen (15) additional days' written Notice to the Owner and the A/E, stop the Work until payment of the amount owing has been received. In such event, the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, which shall be effected by appropriate Change Order as provided herein.

9.8 SUBSTANTIAL COMPLETION AND GUARANTEE BOND

9.8.1 Unless otherwise specified in Article 9.9, Final Completion and Final Payment, when the Contractor considers that the Work, or a designated portion thereof which is acceptable to the Owner, is substantially complete as defined in Article 8, Contract Time, the Contractor shall request in writing that the A/E and the Owner perform a Substantial Completion inspection. Prior to such inspection the Contractor shall:

- .1 If applicable, secure a Certificate of Occupancy for the Project or a designated portion thereof; and
- .2 Submit five (5) copies each of the Operations and Maintenance Manuals to the A/E as specified and one (1) copy to the Owner.

9.8.2 The Owner shall determine whether the Work is substantially complete and shall compile a punch list of items to be completed or corrected. 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.

9.8.3 When the Owner on the basis of his inspection determines that the Work or a designated portion thereof is substantially complete, the A/E will then prepare a Certificate of Substantial Completion which shall establish the Date of Substantial Completion and shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work and insurance. The Certificate of Substantial Completion shall be submitted to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.

- 9.8.4 The Contractor shall have thirty (30) days from the Date of Substantial Completion to complete all items on the punch list to the satisfaction of the Owner. If the Contractor fails to complete all punch list items within the designated time, the Owner shall have the option to correct or conclude any remaining items by utilizing its own forces or by hiring others. The cost of such correction of remaining punch list items by the Owner or others shall be deducted from the final payment to the Contractor, and if the Owner has not retained sufficient funds to cover the cost, Contractor or its surety shall pay the difference within 30 days of a written demand by the Owner to do so.
- 9.8.5 Guarantees and warranties required by the Contract Documents shall commence on the Date of Final Completion of the Work, unless otherwise provided in the Certificate of Substantial or Final Completion, or the Contract Documents. Provided, however, that if Contractor does not complete certain punch list items within the time period, specified in 9.8.4, all warranties and guarantees for such incomplete Punch List items shall become effective upon issuance of final payment for the Work.
- 9.8.5.1 The Contractor shall guarantee for a term of one (1) year from the date of Final Completion or Final Payment, whichever comes later, (unless otherwise provided for in the Certificate(s) of Substantial or Final Completion or the Contract Documents): (1) the quality and stability of all materials equipment and Work; (2) all the Work against defects in materials, equipment or workmanship; and (3) all shrinkage, settlement or other faults of any kind which are attributable to defective materials or workmanship. The Contractor shall remedy at his own expense, when so notified in writing to do so by the Owner, and to the satisfaction of the Owner, the Work or any part thereof that does not conform to any of the warranties and guaranties described in the Contract Documents- or that otherwise does not conform to the requirements of the Contract Documents
- 9.8.5.2 In order to make good the guarantee as herein required, the Contractor shall deposit with the Owner, after Substantial Completion but before Final Payment, a Guarantee Bond(s) issued by a surety licensed to do business in Virginia and otherwise acceptable to the Owner, for the faithful performance of the guarantee. Said Bond(s) shall be for a period of one (1) year from the date the guaranties and warranties commence and in the amount of five percent (5%) of the final gross value of the Contract.
- 9.8.5.3 The Contractor shall complete repairs during the guarantee period, within five (5) working days after the receipt of Notice from the Owner, and if the Contractor shall fail to complete such repairs within the said five (5) working days, the Owner may employ such other person or persons as it may deem proper to make such repairs and pay the expenses thereof out of any sum retained by it, provided nothing herein contained shall limit the liability of the Contractor or his surety to the Owner for non-performance of the Contractor's obligations at any time.
- 9.8.6 The issuance of the Certificate of Substantial Completion does not indicate final acceptance of the Work by the Owner, and the Contractor is not relieved of any responsibility for the Work except as specifically stated in the Certificate of Substantial Completion.
- 9.8.7 Upon Substantial Completion of the Work, or designated portion thereof, and upon application by the Contractor and certification by the A/E, the Owner shall make payment, adjusted for retainage and payments withheld, if any, for such Work or portion thereof, as provided in the Contract Documents.
- 9.8.8 Should the Owner determine that the Work or a designated portion thereof is not substantially complete, he shall provide the Contractor a written Notice stating why the Work or designated portion is not substantially complete. The Contractor shall expeditiously complete the Work and shall re-request in writing that the Owner perform a Substantial Completion inspection.

9.9 FINAL COMPLETION AND FINAL PAYMENT

9.9.1 A Certificate of Final Completion shall be issued by the A/E prior to final payment. At the Owner's sole option, this Final Completion Certificate may be issued without a Certificate of Substantial Completion. The Contractor, prior to application for Final Payment and within the time specified for completion of the Work, shall complete all Work, to include punch list items and provide operation and maintenance manuals and as-built data, for the Work, as completed and in place. Said Certificate of Final Completion shall be issued, even if a Certificate of Substantial Completion has been issued previously and temporary authority to operate the Work has been granted.

9.9.1.1 The Certificate of Final Completion shall certify that all Work has been completed in accordance with Contract Documents and is ready for use by the Owner.

9.9.2 For all projects where Substantial Completion Certificates have been issued for various portions of the Work, at differing times, the Contractor shall request and the Owner shall, prior to final payment, issue a Certificate of Final Completion which certifies that all required Work, including punch list items, has been completed in accordance with the Contract Documents.

9.9.3 Neither the final payment nor any remaining retainage shall become due until the Contractor submits to the A/E the following:

- .1 An Application for Payment for all remaining monies due under the -Contract.
- .2 Consent of surety to final payment;
- .3 If required by the Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of claims arising out of the Contract, to the extent and in such form as may be designated by the Owner. If any Subcontractor refuses to furnish waiver of claims satisfactory to the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify Owner against any such claim. If any such claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such claim, including all costs and reasonable attorneys' fees;
- .4 As-built drawings, operation and maintenance manuals and other project closeout submittals, as required by the Contract Documents;
- .5 Construction releases as required by the Contract Documents from each property owner on whose property an easement for construction of the Work has been obtained by the Owner, such release to be in the forms to be provided by the Owner. This release is for the purpose of releasing the Owner and the Contractor from liability, claims, and damages arising from construction operations on or adjacent to the easement and includes proper restoration of the property after construction. It shall be the Contractor's sole responsibility to obtain all such releases and furnish them to the Owner; and
- .6 A written certification that:
 - .1 The Contractor has reviewed the requirements of the Contract Documents,
 - .2 The Work has been inspected by the Contractor for compliance with all requirements of the Contract Documents,
 - .3 Pursuant to this inspection, the Contractor certifies and represents that the Work complies in all respects with the requirements of the Contract Documents,

- .4 The Contractor further certifies and represents that all equipment and systems have been installed in accordance with the Contract Documents and have been tested in accordance with specification requirements and are operational, and
 - .5 The Contractor hereby certifies and represents that the Work is complete in all respects and ready for final inspection.
- 9.9.4 Upon receipt of the documents required in subparagraph 9.9.3 and upon receipt of a final Application for Payment, the A/E and Owner will promptly make a final inspection. When the A/E finds the Work acceptable under the Contract Documents and the Contract fully performed, he will issue within seven (7) days a final Certificate for Payment and a Final Certificate of Completion.

The Certificate of Completion will state that to the best of his knowledge, information and belief, and on the basis of his observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance designated in the final Certificate for Payment is due and payable. The final Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth in Subparagraph 9.9.3 have been fulfilled. The Owner shall review the Certificate of Payment and shall accept it and issue final acceptance, or reject it and notify the Contractor, within ten (10) days. Final payment to the Contractor shall be made within thirty (30) days after final acceptance. All prior estimates and payments, including those relating to Change Order work, shall be subject to correction by this final payment.

- 9.9.5 The making of Final Payment shall constitute a waiver of all claims by the Owner, except those arising from:
- .1 Unsettled claims;
 - .2 Faulty, defective, or non-conforming Work discovered or appearing after Substantial or Final Completion;
 - .3 Failure of the Work to comply with the requirements of the Contract Documents;
 - .4 Terms of any warranties or guarantees required by the Contract Documents; or
 - .5 Fraud or bad faith committed by the Contractor or any subcontractor or supplier during performance of Work but discovered by Owner after Final Payment.
- 9.9.6 The acceptance of Final Payment shall constitute a waiver of all claims by the Contractor, except those previously made in writing and so identified by the Contractor; as unsettled at the time of the final Application for Payment. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this Contract or the Performance, Payment, or Guarantee Bonds.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

- 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The requirement applies continuously throughout the Contract performance, until Final Payment is made, and is not limited to regular working hours.

10.2 SAFETY OF PERSONS AND PROPERTY

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

- .1 All persons performing any of the Work and all other persons who may be affected thereby;
- .2 All the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-subcontractor's. Machinery, equipment and all hazards shall be guarded or eliminated in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable law; and
- .3 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.

10.2.2 The Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules, regulations, permits, resolutions and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.

The Contractor shall at all times safely guard the Owner's property from injury or losses in connection with the Contract. Contractor shall at all times safely guard and protect his Work and adjacent property as provided by law and the Contract Documents, from damage. All passageways, guard fences, lights and other facilities required for protection by local authorities or local conditions must be provided and maintained without additional cost to the Owner.

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

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

10.2.5 The Contractor is responsible for the proper packing, shipping, handling and storage (including but not limited to shipment or storage at the proper temperature and humidity) of materials and equipment to be incorporated in the Work, so as to insure the preservation of the quality and fitness of the materials and equipment for proper installation and incorporation in the Work, as required by the Contract Documents.

For example, but not by way of limitation, Contractor shall, when necessary, place material and equipment on wooden platforms or other hard and clean surfaces and not on the ground and/or place such material and equipment under cover or in any appropriate shelter or facility. Stored materials or equipment shall be located so as to facilitate proper inspection. Material and equipment that is delivered crated shall remain crated until ready for installation. Lawns, grass plots or other private property shall not be used for storage purposes without the written permission of the owner or lessee unless otherwise within the terms of the easements obtained by the Owner.

10.2.6 In the event of any indirect or direct damage to public or private property referred to in Paragraphs 10.2.1.2 and 10.2.1.3, caused in whole or in part by an act, omission or negligence on the part of the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable, the Contractor shall at his own expense

and cost promptly remedy and restore such property to a condition equal to or better than existing before such damage was done. The Contractor shall perform such restoration by underpinning, replacing, repairing, rebuilding, replanting, or otherwise restoring as may be required or directed by the Owner, or shall make good such damage in a satisfactory and acceptable manner. In case of failure on the part of the Contractor to promptly restore such property or make good such damage, the Owner may, upon two (2) calendar days written Notice, proceed to repair, replace, rebuild or otherwise restore such property as may be necessary and the cost thereof, or a sum sufficient in the judgment of the Owner to reimburse the owners of property so damaged, will be deducted from any monies due or to become due the Contractor under the Contract. If insufficient monies remain due or will become due to pay such sum, Contractor or its surety shall, within 30 days of receipt of a written demand from Owner to do so, pay Owner such sum.

- 10.2.7 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents and the protection of material, equipment and other property. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner.
- 10.2.8 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger the safety of any portion of the Work.
- 10.2.9 The Contractor shall give notice in writing at least forty-eight (48) hours before breaking ground, to all persons, Public Utility Companies, owners of property having structures or improvements in proximity to site of the Work, superintendents, inspectors, or those otherwise in charge of property, streets, water pipes, gas pipes, sewer pipes, telephone cables, electric cables, railroads or otherwise, who may be affected by the Contractor's operation, in order that they may remove any obstruction for which they are responsible and have representative(s) on site to see that their property is properly protected. Such notice does not relieve the Contractor of responsibility for any damages and claims. Nor does such notice relieve the Contractor from his responsibility to defend and indemnify the Owner from actions resulting from the Contractor's performance of such work in connection with or arising out of the Contract.
- 10.2.10 The Contractor shall protect all utilities encountered while performing its work, whether indicated on the Contract Drawings or not. The Contractor shall maintain utilities in service until moved or abandoned. The Contractor shall exercise due care when excavating around utilities and shall restore any damaged utilities to the same condition or better as existed prior to starting the Work, at no cost to the Owner. The Contractor shall maintain operating utilities or other services, even if they are shown to be abandoned on the drawings, in service until new facilities are provided, tested and ready for use.
- 10.2.11 The Contractor shall return all improvements on or about the site and adjacent property which are not shown to be altered, removed or otherwise changed to conditions which existed prior to starting the Work.
- 10.2.12 The Contractor shall protect the Work, including but not limited to, the site, stored materials and equipment, excavations, and excavated or stockpiled soil or other material, intended for use in the Work, and shall take all necessary precautions to prevent or minimize damage to same and to prevent detrimental effect upon his performance or that of his Subcontractors, caused by or due to rain, snow, ice, run-off, floods, temperature, wind, dust, sand and flying debris. For example, but not by way of limitation, Contractor shall, when necessary, utilize temporary dikes, channels or pumping to carry-off, divert or drain water, and shall as necessary tie-down or otherwise secure the Work and employ appropriate covers and screens.

10.3 OBLIGATION OF CONTRACTOR TO ACT IN AN EMERGENCY

- 10.3.1 In case of an emergency that threatens immediate loss or damage to property and/or safety of life, the Contractor shall act to prevent threatened loss, damage, injury or death. The Contractor shall notify the Owner of the situation and all actions taken immediately thereafter. If the Contractor fails to act and any loss, damage, injury or death occurs that could have been prevented by the Contractor's prompt and immediate action, the Contractor shall be fully liable to the Owner or any other party for all costs, damages, claims, actions, suits, costs of defense, and all other expenses arising therefrom or relating thereto.
- 10.3.2 Prior to commencing the Work and at all times during the performance of the Work, the Contractor shall provide the Owner two, twenty-four hour (24) emergency phone numbers where his representatives can be contacted at any time.

ARTICLE 11 INSURANCE FOR CONTRACTS

11.1 CONTRACTOR'S INSURANCE

11.1.1 During the term of this Contract, the Contractor shall procure and maintain insurance coverages with insurance companies rated by A. M. Best Company as A – VIII or better. The company(ies) shall be authorized to do business under the laws of the Commonwealth of Virginia and be acceptable to the City of Lynchburg and shall provide the following minimum types of insurance:

- a. **Commercial General Liability Insurance** – This will cover claims for Bodily Injury, Property Damage, Personal and Advertising Injury, Products and Completed Operations, which may arise from operations under the Contract, whether such operations be performed by the Contractor or by any Subcontractor or Independent Contractor, or by anyone directly or indirectly employed by any of them. Such insurance shall include coverages "X", "C" and "U" for explosion, collapse of other structures and underground utilities, as well as Contractual Liability Insurance covering the requirements outlined in the General Conditions. This insurance shall name the City, the City Council and its employees as additional insureds *by endorsement* to the Commercial General Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Lynchburg as an additional insured. The City of Lynchburg shall be entitled to protection up to the full limits of the Contractor's policy regardless of the minimum requirements specified in this Contract. If endorsements to the Commercial General Liability insurance policies cannot be made, then separate policies providing such protection shall be purchased by the Contractor.

1. The Policy shall have the following *minimum* limits:

\$1,000,000 Each Occurrence Limit
\$1,000,000 General Aggregate Limit
\$1,000,000 Personal and Advertising Injury Limit
\$1,000,000 Products and Completed Operations Aggregate Limit
\$5,000 Medical Expense Limit

This insurance shall include the following provisions and /or endorsements:

- 1) The General Aggregate limit shall apply on a "per project" and on a "per location" basis;
- 2) Coverage shall apply to all liability arising from all premises and operations conducted by the Contractor, Subcontractors and independent contractors;
- 3) The Contractor agrees that liability arising from Products and Completed Operations will be covered. Such liability coverage will be maintained for two years after completion of the Work.

- 4) The Contractor shall require each of his Subcontractors to procure and maintain Commercial General Liability Insurance of the type specified in these Contract Documents in the minimum amounts required by the Owner and the Contractor (which shall be the amounts required by this paragraph 11.1.1. of Contractor unless otherwise agreed in writing by Owner), during the term of their subcontracts.

b. **Worker's Compensation and Employer's Liability Insurance** for the Contractor's employees engaged in the Work under this Contract, in accordance with statutory requirements of the Commonwealth of Virginia. The Contractor shall require each of his Subcontractors to provide Worker's Compensation and Employer's Liability Insurance for all of the Subcontractor's employees engaged on such subcontracts. If any class of employees engaged on Work under the Contract is not protected under the Worker's Compensation statute, the Contractor shall provide similar protection for these employees in amounts not less than the legal requirements. The amount of Employer's Liability Insurance for the Contractor and each of his Subcontractors shall be not less than:

\$100,000 per employee for Bodily Injury.
\$100,000 per employee for disease
\$500,000 per policy for disease

The Worker's Compensation and Employer's Liability Insurance policy shall include an "all states" or "other states" endorsement.

c. **Commercial Automobile Liability Insurance**, including coverage for owned, hired, non owned and borrowed vehicles used in the work with *minimum* limits of \$1,000,000 Combined Single Limit per occurrence. This insurance shall name the City, the City Council and its employees as additional insureds *by endorsement* to the Commercial Automobile Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Lynchburg as an additional insured. The City of Lynchburg shall be entitled to protection up to the full limits of the Contractor's policy regardless of the minimum requirements specified in this Contract.

d. **Umbrella Liability or Excess Liability Insurance** with the following minimum limits of:

\$5,000,000 Each Occurrence
\$5,000,000 Annual Aggregate

The following policies shall be scheduled as underlying policies:

Commercial General Liability
Commercial Automobile Liability
Employers Liability

This insurance shall name the City, the City Council and its employees as additional insureds *by endorsement* to the Umbrella or Excess Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Lynchburg as an additional insured. The City of Lynchburg shall be entitled to protection up to the full limits of the Contractor's policy regardless of the minimum requirements specified in this Contract.

11.1.2 Proof of insurance for each type of coverage listed herein shall be provided within 10 days after issuance of the award letter for the Contract, and no Work shall proceed unless all such insurance is in effect. The Contractor shall not allow any Subcontractor to commence work on his subcontract until all such insurance of the Subcontractor has been so obtained and approved by the Contractor and found to be in accordance with the requirements set forth herein. The Contractor certifies by commencement of

the Work that his insurance and that of Subcontractors is in effect and meets the requirements set forth herein.

- 11.1.3 The Contractor shall purchase and maintain required liability and all other insurance as is appropriate for the Work being performed and furnished. The insurance shall provide protection from claims which may arise out of or result from Contractor's performance and furnishing of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed or furnished by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:
- a. claims under Worker's Compensation, Employers Liability, disability benefits, and other similar employee benefit acts;
 - b. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - c. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - d. claims for damages insured by personal injury liability coverage which are sustained: (1) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor; or (2) by any other person for any other reason;
 - e. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - f. claims 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.
- 11.1.4 The insurance required to be purchased and maintained by the Contractor shall:
- a. include completed operations insurance;
 - b. with respect to any other insurance coverage written on a claims-made basis, remain in effect for at least 2 years after final payment (and Contractor shall furnish the City and A/E evidence satisfactory to the City of continuation of such insurance at final payment and 1 year thereafter);
 - c. contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance.
- 11.1.5 All of the aforesaid insurance policies must be endorsed to provide that the insurance company ***shall give 30 days written notice to the City*** if the policies are to be terminated or if any changes are made during the Contract period which will affect in any way the insurance provided pursuant to such policy. Before starting the Work, the Contractor shall provide the City with a copy of each policy that he and each of his Subcontractors is required to carry in accordance with this Article 11, together with receipted bills evidencing proof of premium payment. These policies shall contain endorsements to the policies naming the City of Lynchburg as an additional insured as required.
- 11.1.6 Nothing contained herein shall effect, or shall be deemed to affect, a waiver of the City's sovereign immunity under law.

ARTICLE 12 CHANGES AND MODIFICATIONS IN THE WORK

12.1 *CHANGES IN THE WORK*

- 12.1.1 The Owner, without invalidating the Contract and without notice to the surety, may order a change to the Work consisting of additions, deletions or other revisions to the general scope of the Contract, or changes in the sequence of the performance of the Work. The Contract Sum and the Contract Time shall be adjusted accordingly. All such changes in the Work shall be authorized by Change Order, Modification, or Change Directive, and all Work involved in a change shall be performed in accordance with the terms and conditions of the Contract Documents. If the Contractor should proceed with a change in the Work upon an oral order, by whomsoever given, it shall constitute a waiver by the Contractor of any claim for an increase in the Contract Sum and/or Contract Time, on account thereof.

12.2 *FIELD ORDER*

- 12.2.1 A Field Order is a written order to the Contractor signed by the Owner's designated representative, interpreting or clarifying the Contract Documents or directing the Contractor to perform minor changes in the Work. Any work relating to the issuance of a Field Order shall be performed promptly and expeditiously and without additional cost to the Owner and within the Contract Time, unless the Contractor submits a Proposed Change Order, defined below, which is approved by the Owner. Field Orders shall be numbered consecutively by date of issuance by the Owner.

12.3 *OWNER CHANGE REQUEST*

- 12.3.1 An Owner Change Request is a written request from the Owner to the Contractor that describes a proposed change in the Work. The Contractor is required to submit a complete proposal for the total cost and additional time, if any, necessary to perform the proposed change in the Work. Owner Change Requests shall be numbered consecutively by date of issuance by the Owner.

12.4 *CONTRACTOR'S PROPOSED CHANGE ORDER*

- 12.4.1 A Contractor's Proposed Change Order is a written request from the Contractor to the Owner requesting a change in the Contract Sum and/or Contract Time. A Contractor's Proposed Change Order is submitted as a proposal in response to a Owner Change Request or as a claim for an increase in the Contract Sum or Contract Time pursuant to the issuance of a Field Order, or as a result of unforeseen circumstances, such as an unknown site conditions.

Change Orders for unforeseen site conditions will only be entertained if the Contractor has not accepted responsibility for the unforeseen site conditions pursuant to other provisions in the Contract Documents. A Contractor's Proposed Change Order must be submitted within twenty (20) calendar days of the issuance of a Owner Change Request or a Field Order or the discovery of an unforeseen circumstance. The Contractor shall not be entitled to any adjustment to the Contract Time or Contract Sum if Contractor fails to comply strictly with the requirements of the preceding sentence. Contractor's Proposed Change Orders shall be numbered consecutively by date of issuance by the Contractor. The Contractor shall also indicate on the Proposed Change Order the number of the Owner Change Request or the Field Order to which it responds. The Contractor understands and agrees to the City's provisions and policy regarding Change Orders as outlined in Article 1, section 1.1.2 of these General Conditions.

- 12.4.2 In the case of unit price items, it is understood and agreed by the Contractor that the estimates of the quantities in unit price items are approximate only and are presented solely for the purpose of comparing bids and may not represent the actual amount of work to be performed. The Contractor, therefore, understands and agrees that the Owner reserves the right to increase, decrease or eliminate

entirely the quantity of work to be done under any item. If called upon to do more work under any unit price item named in the Bid Documents, he will perform all such additional work and accept as payment the unit price named in the proposal, subject to the 20% deviation limitations specified in subparagraph 12.4.2.2.

- 12.4.2.1 The Contractor's Proposed Change Order shall be determined by applicable unit prices, if any, as set forth in the Contract.
- 12.4.2.2 However, if changes in quantities are of an item increase the actual work to more than twenty percent (20%) of the original bid quantity for that item, or decrease quantities of that item more than 20% of the original bid quantity for that item, then the Owner or the Contractor shall have the right to request a decrease or an increase in the unit price for the item for quantities greater than 120% or less than 80% of the original bid quantity for that item.
- 12.4.2.3 It shall be understood that such unit prices shall constitute full payment for the extra work performed, including, but not limited to, "general conditions" costs, plant, materials, labor, equipment, overhead, profit, and safety requirements.
- 12.4.3 If no such unit prices are set forth, the Contractor's proposal shall be on a lump sum basis and shall be itemized and segregated by labor, equipment, and materials for the various components of the change in the Work (no aggregate labor total will be acceptable) and shall be accompanied by signed proposals of any Subcontractors who will perform any portion of the change in the Work and of any persons who will furnish materials or equipment for incorporation therein.
 - 12.4.3.1 The portion of the proposal relating to labor, whether by the Contractor's forces or the forces of any of its Subcontractors, may include reasonably anticipated gross wages of job site labor, including foremen, who will be directly involved in the change in the Work (for such time as they will be so involved), plus separately identified payroll costs (including premium costs of overtime labor, if overtime is authorized, Social Security, Federal or State unemployment insurance taxes and fringe benefits required by collective bargaining agreements entered into by the Contractor or any such Subcontractor in connection with such labor).
 - 12.4.3.2 The portion of the proposal relating to materials may include the reasonably anticipated direct costs to the Contractor or to any of its Subcontractors of materials to be purchased for incorporation in the change in the Work, plus transportation and applicable sales or use taxes.
 - 12.4.3.3 The proposal may further include the Contractor's and any of his Subcontractor's reasonably anticipated equipment rental costs, except small hand tools, in connection with the change in the Work.
- 12.4.4 Base Cost is defined as the total of labor, material and equipment rentals as described in subparagraphs 12.4.3.1, 12.4.3.2 and 12.4.3.3. The actual net cost in money to the Owner for the change in the Work shall be computed as follows:
 - .1 If the Contractor performs the change in the Work without use of Subcontractors or sub-subcontractors, his compensation will be the Base Costs as described above, plus a maximum mark-up of 15% for overhead and profit.
 - .2 If the work is performed by a bona fide Subcontractor, the Subcontractor's compensation will be the Base Costs as described above plus a maximum mark-up of 15% for overhead and profit. The

Contractor's compensation will be a maximum mark-up of five percent (5%) of the Subcontractors Base Costs for his overhead and profit.

.3 If the Work is performed by a bona fide Sub-subcontractor, the Subcontractor's compensation will be the Base Costs as herein described, plus a maximum mark-up of 15% for overhead profits. The mark-up of any Sub-subcontractor's work by the Contractor and all intervening tiers of Subcontractors shall not exceed a total of 10%.

12.4.5 The mark-up on the cost of labor, materials, and equipment described in Paragraphs 12.4.4.1, 12.4.4.2, and 12.4.4.3 shall be all the compensation to which the Contractor, Subcontractors and Sub-subcontractor are entitled for all indirect costs associated with or relating to the change in the Work including, but not limited to, labor and/or equipment inefficiency, changes in sequence, delays, interferences, impact on unchanged work, gross receipts tax, superintendent, small tools, reproduction, administration, insurance, unrelated safety requirements, temporary structures and offices, all other general and administrative, home office and field office expenses.

12.4.6 The Proposed Change Order may also include the cost of increases in premiums for the Payment Bond and the Performance Bond, provided coverage for the cost of the change in Work results in such increased costs. At the Owner's request, the Contractor shall provide proof of his notification to the surety of the change in the Work and of the surety's agreement to include such change in its coverage. The cost of the increase in premiums shall not be marked up.

12.4.7 In the event that it is necessary to increase the Contract Time in order to perform the change in the Work, the Contractor shall provide an estimate of the increase in the Contract Time as part of the Proposed Change Order. The Contractor's request for a time extension shall be evaluated in accordance with the criteria described in Article 8.3, Claims for Time Extensions.

12.4.8 If the Contractor's Proposed Change Order is rejected by the Owner as being within the scope of the Work required by the Contract Documents, the Owner may, at its sole option and discretion, direct the Contractor to perform the Work which is the subject of the said Proposed Change Order, with claimed compensation to be accounted for pursuant to 12.6 and to be subject to the procedures of Article 13. The Contractor shall then promptly proceed with said Work. Nothing herein shall excuse the timely performance by the Contractor of the Work because any Proposed Change Order is pending.

12.5 CHANGE ORDER

12.5.1 A Change Order is a written order to the Contractor signed by the Owner, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum and/or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum and/or the Contract Time. Change Orders shall be numbered consecutively by date of issuance by the Owner and shall, if applicable, indicate the number of the Field Order(s), Request for Proposal(s) and/or Proposed Change Order(s) to which they relate.

12.5.1.1 If the Owner determines that the Contractor's Proposed Change Order, submitted pursuant to Article 12.4 for a change in the Contract Sum or Contract Time, is acceptable, the Owner shall prepare and issue a Change Order which will authorize the Contractor to proceed with the change in the Work with the adjustment to Contract Sum and Contract Time stated in the Proposed Change Order, or as otherwise may be agreed upon by the parties. The amounts stated in the Change Order for the adjustment to Contract Sum and Contract Time for the change in the Work shall be binding on the parties.

- 12.5.2 After issuance of the Change Order, the Contractor shall ensure that the amount of the Performance and Payment Bond coverage has been revised to reflect the increase in the Contract Sum due to the Change Order. Notwithstanding the foregoing, Contractor's failure to do so shall not release any surety from its obligations under any bonds.

12.6 CHANGE DIRECTIVE

- 12.6.1 If Owner and Contractor cannot agree as to whether something constitutes a change to the Work originally contemplated by the Contract Documents, or if they cannot agree as to the adjustment to the Contract Sum or Contract Time required for what Owner acknowledges to be a change to the Work constituting Extra Work, Owner may, in his sole discretion, issue a written Change Directive directing Contractor to perform such work. Contractor shall then promptly proceed with the work at issue. Owner may elect, in its sole discretion, to have the compensation or claimed compensation for such work accounted for on either a time and material basis or lump sum basis as described in 12.6.2 and 12.6.3.
- 12.6.2 If Owner elects to have the compensation and/or claimed compensation accounted for on a time and materials basis, the following procedures apply:
- 12.6.2.1 Change Directive work, the compensation or claimed compensation for which is being accounted for on a time and material basis shall be performed, whether by the Contractor's forces or the forces of any of its Subcontractors' or Sub-subcontractors', at actual cost to the entity performing the Work (without any charge for administration, clerical expense, supervision or superintendent of any nature whatsoever). The percent mark-ups for the Contractor, Subcontractors and Sub-subcontractor's shall be as described in subparagraphs 12.4.4 and 12.4.5.
- 12.6.2.2 Prior to starting the Change Directive work on a time and material basis, the Contractor shall notify the Owner in writing as to what labor, materials, equipment or rentals are to be used for the change or claimed change in the Work. During performance, the Contractor shall submit to the Owner daily time and material tickets, which shall list the categories and amounts of labor and equipment for which Change Directive compensation is to be charged for the previous work day. Such tickets shall specifically include the following information: location and description of the change in the Work, the classification of labor employed, including names and social security numbers of laborers, labor trades used, man hours, wage rates, insurance, taxes and fringe benefits, equipment and materials suppliers' quotations with detailed break-out and pricing, rental equipment hours and rates, and materials quantities and unit prices and such other evidence of cost as the Owner may require.
- 12.6.2.3 The Contractor shall commence submission of daily time and material tickets immediately upon commencement of the Change Directive work and continue to submit them until completion of the Change Directive work. The Owner may require authentication of all time and material tickets and invoices by persons designated by the Owner for such purpose.
- 12.6.2.4 No payment will be made to the Contractor for any portion of the Change Directive work that Owner acknowledges to be Extra Work unless and until such daily time and material tickets and invoices are submitted. The submission of any such ticket or invoice shall not constitute an acknowledgment by the Owner that the items thereon were reasonably required for the Change Directive work.

12.6.2.5. For any work performed on a time and material basis, the Contractor shall submit its complete submission of the reasonable actual cost and time to perform the change in the Work within twenty (20) days after such Work has been completed. If Change Directive work includes both Work that Owner acknowledges to be Extra Work and work that Owner disputes to be Extra Work, Contractor shall clearly segregate its accounting for the two. The Owner shall review the costs and time submitted by the Contractor on the basis of reasonable expenditures and savings of those performing the Change Directive work. If such costs and time are acceptable to the Owner, or if the parties otherwise agree to the actual reasonable cost to perform the Change Directive work, a Change Order will be issued for the cost and time agreed upon. The amounts stated in the Change Order for the cost and time to perform the Change Directive work shall be binding upon the parties.

12.6.3 If Owner elects to have the compensation or claimed compensation accounted for on a lump sum basis, Owner may make a unilateral determination of a reasonable adjustment in Contract Sum and Contract Time due to the Change Directive. Any unresolved dispute about the reasonableness of Owner's unilateral determination shall be subject to Article 13, Claims and Dispute Procedure.

12.7 DECREASES AND WORK NOT PERFORMED (Deductive Change Orders)

12.7.1 Should it be deemed expedient by the Owner to decrease the dimensions, quantity of material or Work, or vary in any other way the Work required by the Contract Documents, the Owner may direct by written Change Order, such decreases to be made or performed without in any way affecting the validity of the Contract. The Contractor shall comply with the Change Order from the Owner. The difference in expense occasioned by such decrease shall be deducted from the amount payable under this Contract.

12.7.2 When Work is deleted from the Contract by Owner, the amounts to be credited to the Owner shall reflect the same current pricing as if the Work were being added to the Contract at the time the deletion is ordered, and Contractor shall provide documentation for a credit as specified in Article 12.5.4. If such deleted materials and equipment shall have already been purchased and stored on site and cannot be used in other projects, cannot be returned for credit or cannot be returned for credit at the price paid by the Contractor at the time of purchase, the Contractor shall be entitled, upon proper documentation and certification, to an adjustment in the pricing of the credit to avoid hardship to the Contractor. If necessary in order to establish such reasonable value, the Contractor may be required to submit a detailed breakdown of his original bid and all documents upon which Contractor's bid was based for the items or Work involved.

12.7.3 If Work is not performed, and such deletion of Work was not directed or approved by the Owner, the Owner shall ascertain the amount of the credit due.

12.8 CHANGES IN LINE AND GRADE

12.8.1 The Owner reserves the right to make such alterations in the line and grade of various structures or pipe lines shown on the drawings, as may be necessitated by conditions found during construction or that in the judgment of the Owner appears advisable. Such alterations shall in no way affect the validity of the Contract

12.8.1.1 In case of a unit price contract, if such changes increase the amount of the Work or materials, the Contractor will be paid according to the quantity of Work actually done at the prices established for such Work under the Contract.

12.8.1.2 In case of a lump sum contract, the price for the Work shall be determined as specified in Article 12.4, Proposed Change Order.

12.9 SUBSURFACE CONDITIONS FOUND DIFFERENT

12.9.1 Should the Contractor encounter subsurface and/or latent conditions at the site materially differing from those shown on the drawings or indicated in the specifications, he shall immediately give Notice to the Owner of such conditions before they are disturbed. The Owner shall thereupon promptly investigate the conditions and if he finds that they materially differ from those shown on the drawings or indicated in the specifications, he shall at once make such changes in the drawings and/or specifications as he may find necessary. Any increase or decrease of cost resulting from such changes shall be adjusted in the manner provided herein for adjustments as to extra and/or additional work and changes. Notwithstanding the foregoing, if the Contract Documents indicate elsewhere that excavation is to be on an unclassified basis, Contractor shall not be entitled to any adjustment to the Contract Sum or Contract Time based upon this 12.9.

12.10 OTHER CLAIMS

If the Contractor claims that additional cost or time is involved because of, but not limited to, (1) any written interpretation pursuant to Article 2, Architect/Engineer, (2) any order by the Owner to stop the Work pursuant to Article 3, Owner, where the Contractor was not at fault, (3) failure of payment by the Owner pursuant to Article 9 Payments and Completion, or (4) any written order for a minor change in the Work issued pursuant to Article 12.8, Changes in Line and Grade, the Contractor shall make such claim as provided in Section 12, Changes and Modification in the Work, and Article 13, Claims and Dispute Procedure.

ARTICLE 13 CLAIMS AND DISPUTE PROCEDURE

Any Claims by the Contractor arising under or relating to the Contract or the Contract Documents shall only be resolved as follows:

13.1. INITIAL NOTICE, SUBMISSION OF CLAIM, AND CONSIDERATION.

- a. The Contractor shall give the Owner and the A/E written notice of any Claim within ten (10) days of the beginning of the occurrence of the event leading to the Claim. The written notice shall be a document from the Contractor addressed to the Owner's and A/E's officials or employees designated by the Contract Documents to receive such notice, or if no one is so designated, to the Owner's City Manager and to the A/E. The written notice shall clearly state the Contractor's intention to make a claim, shall describe the occurrence involved, and shall be transmitted in a manner to ensure receipt by the Owner and A/E within the ten (10) days. The Contractor shall submit the Claim and any supporting data to the Owner and A/E within thirty (30) days after the occurrence giving rise to the Claim ends. The burden shall be on the Contractor to substantiate that it has given written notice and submitted its Claim in accordance with this provision.
- b. The Claim must (i) be certified under oath as true and correct by a principal of Contractor; (ii) must be for specific relief; (iii) if any money is sought, must specify the dollar amount sought; and (iv) must contain sufficient supporting documentation to reasonably allow its consideration, including without limitation, any documentation required by the Contract Documents. The burden shall be on the Contractor to substantiate the Claim.
- c. The Contractor shall comply with all other terms and conditions of the Contract Documents, including without limitation, those in Articles 8 and 12, as applicable. No decision by the A/E on

a claim shall be binding on the Owner, but such decision shall have whatever effect on the Contractor that the Contract Documents provide.

- d. Following consideration by the A/E, and following initial, informal consideration by the Owner's City Manager or his designee, the parties shall endeavor to resolve any Claim through direct negotiations, and if such direct negotiations fail, and if the Owner requests, by non-binding mediation conducted pursuant to the Rules of the American Arbitration Association, with the site of the mediation being Lynchburg, Virginia.
- e. Should the Claim remain unresolved for more than 60 days after it is submitted, then the City Manager or his designee shall, within no later than 90 days after the Claim's submission, render a written decision on the Claim on behalf of the Owner . The Contractor may not institute any legal action with respect to the Claim until after the City Manager or his designee renders his written decision or 90 days from its receipt by the City Manager has passed, whichever comes first. The only effect of the failure by the City Manager or his designee to render a decision within this 90-day period is to allow the Contractor to institute a legal action pursuant to this provision without having to wait for a decision on the Claim concerned.

13.2 APPEAL OF DENIAL OF CLAIM.

- a. If the Owner denies in whole or part a Claim by Contractor or more than 90 days have passed since the Claim was received by the City Manager but no written decision has been issued, the Contractor may appeal denial of the claim by instituting an action in the Lynchburg Circuit Court, Lynchburg, Virginia, or if the subject or amount in controversy is within its jurisdiction, the Lynchburg General District Court, Lynchburg, Virginia, and may thereafter pursue all available appeals in Virginia state courts, to the extent they have jurisdiction.
- b. The Contractor must initiate its appeal of the Claim within 180 days of the date it first has the right to do so or the Claim will be barred and the Owner's decision will be binding and conclusive.
- c. The Contractor may not amend its Claim on appeal to increase the amount of money sought.
- d. In the event of any Claim arising, Contractor shall continue its performance diligently during such Claim's pendency and thereafter as if no Claim had arisen. During the pendency of any Claim in connection with the payments of moneys, Contractor shall be entitled to receive payments for non-disputed items, subject to any right of set-off by Owner.

13.3 Notwithstanding anything in the Contract Documents to the contrary, the Owner may, in its discretion, assert a Claim without first resorting to any procedures contained in the Contract Documents.

13.4 "Claim" means a "claim" as defined in the Lynchburg Public Procurement Code.

13.5 Notwithstanding anything in the Contract Documents to the contrary, Owner shall not be liable to Contractor for any damages or increase in the Contract Sum due to delays to Contractor, any Subcontractor, or any other person except due to extent required by Virginia Code § 2.2-4335.

ARTICLE 14 UNCOVERING AND CORRECTION OF WORK

14.1 UNCOVERING OF WORK

14.1.1 If any portion of the Work should be covered contrary to: (1) the request of the A/E or Owner; (2) requirements specifically expressed in the Contract Documents; or (3) the requirements of applicable

permits, it must, if required in writing by the Owner, be uncovered for the Owner's and A/E's observation and shall be replaced at the Contractor's expense.

- 14.1.2 If any other portion of the Work has been covered which the Owner has not specifically requested to observe prior to being covered, the Owner may request to see such Work and it shall be uncovered by the Contractor. If such Work be found in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work be found not in accordance with the Contract Documents, the Contractor shall pay such costs unless it is found that this condition was caused solely by the Owner, in which event the Owner shall be responsible for the payment of such costs. If such Work be found not in accordance with the Contract Documents and the condition was caused by a separate contractor, Contractor may proceed against said separate contractor as provided in Article 6, Work by Owner or by Separate Contractors.

14.2 WARRANTY AND CORRECTION OF WORK

- 14.2.1 The Contractor guarantees and warrants to the Owner all Work as follows:
- .1 That all materials and equipment furnished under this Contract will be new and the best of its respective kind unless otherwise specified;
 - .2 That all Work will be of first-class quality and free of omissions and faulty, imperfect or defective material or workmanship;
 - .3 That the Work shall be entirely watertight and leakproof in accordance with all applicable industry customs and practices, and shall be free of shrinkage and settlement which are attributable to defective materials or workmanship;
 - .4 That the Work, including but not limited to, mechanical and electrical machines, devices and equipment shall be fit and fully usable for its intended and specified purpose and shall operate satisfactorily with ordinary care;
 - .5 That consistent with requirements of the Contract Documents the Work shall be installed and oriented in such a manner as to facilitate unrestricted access for the operation and maintenance of fixed equipment; and
 - .6 That the Work will be free of abnormal or unusual deterioration which occurs because of poor quality materials or workmanship.
- 14.2.2 All Work not conforming to guarantees and warranties specified in the Contract Documents, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment furnished and installed.
- 14.2.3 The Contractor shall within five (5) working days after receipt of written Notice from the Owner during the performance of the Work, reconstruct, replace or correct all Work rejected by the A/E or Owner as defective, as failing to conform to the Contract Documents, or as not in accordance with the guarantees and warranties specified in the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of reconstructing, replacing or correcting such rejected Work, including compensation for the A/E's additional services made necessary thereby.
- 14.2.4 If, within one (1) year after the Date of Final Completion of the Work or designated portion thereof or within one (1) year after acceptance by the Owner of designated equipment or within such longer period

of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be defective, not in accordance with the Contract Documents, or not in accordance with the guarantees and warranties specified in the Contract Documents, the Contractor shall correct it within five (5) working days after receipt of a written Notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition pursuant to 14.3, Acceptance of Faulty, Defective or Non-Conforming Work. This obligation shall survive termination of the Contract. The Owner shall give such Notice within a reasonable time after discovery of the condition.

- 14.2.5 Subject to limitation as prescribed by law, if at any time deficiencies in the Work are discovered which are found to have resulted from fraud or misrepresentation, or an intent or attempt to defraud the Owner by the Contractor, any Subcontractor or supplier, the Contractor will be liable for replacement or correction of such Work and any damages which Owner has incurred related thereto, regardless of the time limit of any guarantee or warranty.
- 14.2.6 Any materials or other portions of the Work, installed, furnished or stored on site which are not of the character or quality required by the specifications, or are otherwise not acceptable to the Owner, shall be immediately removed and replaced by the Contractor to the satisfaction of the Owner, when notified to do so by the Owner.
- 14.2.7 If the Contractor fails to correct defective or nonconforming Work as required by Articles 13.2.3 and 13.2.4, or if the Contractor fails to remove defective or nonconforming Work from the site, as required by Article 13.2.6, the Owner may elect to either correct such Work in accordance with Article 3.5, Owner's Right to Carry Out the Work, or remove and store materials and equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days thereafter, the Owner may, upon ten additional days written Notice, sell such Work at auction or at public or private sale and shall account for the net proceeds thereof, after deducting the costs of the sale and all of the costs that should have been borne by the Contractor, including compensation for the A/E's additional services made necessary thereby. If such proceeds of sale do not cover all costs indicated in the previous sentence, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor or its surety shall pay the difference to the Owner.
- 14.2.8 The Contractor shall bear the cost of making good all work of the Owner, separate contractors or others, destroyed or damaged by such correction or removal required under this Article.

14.3 ACCEPTANCE OF FAULTY, DEFECTIVE OR NON-CONFORMING WORK

If the Owner prefers to accept faulty, defective or nonconforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued at Owner's option, to reflect a reduction in the Contract Sum in an amount to be determined by the Owner.

ARTICLE 15 TERMINATION OF THE CONTRACT

15.1 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

If the Work should be stopped under an order of any court or other public authority for a period of ninety (90) days through no fault of the Contractor or anyone providing services, materials or equipment through him, or if the Owner should fail to pay to the Contractor within thirty (30) days any sum for which a Certificate of Payment has been certified when no dispute exists as to the sum due and Owner has no right to withhold payment under any provision of the Contract Documents, then the Contractor may, upon ten (10) days written Notice to the Owner, stop Work or terminate the Contract and recover from the Owner payment for the cost of the Work actually performed, together with overhead and profit thereon, but profit on the Work performed shall be recovered only to the extent that the Contractor can demonstrate that he

would have had profit on the entire Contract if he had completed the Work. The Contractor may not receive profit or any other type of compensation for parts of the Work not performed. The Contractor may recover the reasonable cost of physically closing down the Site, but no other costs of termination. The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. In no event shall termination of the Contract by the Contractor terminate the obligations of the Contractor's surety on its payment and performance bonds.

15.2 OWNER'S RIGHT TO TERMINATE CONTRACT FOR CAUSE

15.2.1 The Owner may terminate the Contract for cause based upon any of the following grounds:

- .1 If the Contractor should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency.
- .2 If the Contractor should refuse or should repeatedly fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials and equipment.
- .3 If the Contractor should fail to make prompt payment to subcontractors or suppliers of material of labor.
- .4 If the Contractor should disregard laws, ordinances, codes, regulations, or the written instructions of the Architect/Engineer or the Owner.
- .5 If the Contractor be in substantial violation of any provision of the Contract Documents.

15.2.2 For termination for cause based upon the grounds in 15.2.1.1, Owner may terminate without prior notice and without giving Contractor any opportunity to rectify the basis for termination. For termination for cause based upon any other grounds, prior to termination of the Contract, the Owner shall give the Contractor and his surety Notice followed by a ten (10) day period during which the Contractor and/or his surety may rectify the basis for the Notice. If rectified to the satisfaction of the Owner within said ten (10) days, the Owner may rescind its notice of termination. If not, the termination for cause shall become effective at the end of the ten (10) day notice period. Notwithstanding the foregoing, the Owner may, in writing, postpone the effective date of the termination for cause, at its sole discretion, if it should receive reassurances from the Contractor and/or his surety that the basis for the termination will be remedied within a time and in a manner which the Owner finds acceptable. If at any time after such postponement, the Owner determines that Contractor and/or his surety has not or is not likely to rectify the causes of termination in an acceptable manner or within the time allowed, then the Owner may immediately terminate the Contract for cause, without the necessity of allowing any further opportunity by the Contractor and/or surety to rectify the basis for the Notice, by notifying the Contractor and his surety in writing of the termination. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.

15.2.3 Upon termination of the Contract, the Contractor shall immediately cease Work, and the Owner may take possession of the site and of all materials, tools and equipment thereon and finish the Work by whatever method he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Owner has finally completed the Work through its own resources or those of a subsequent contractor. If the Owner's damages, including the expense of finishing the Work, compensation for additional design, managerial and administrative services, any liquidated damages, and any claims by the Owner, shall exceed the unpaid balance of the Contract Sum, the Contractor shall pay the difference to the Owner, together with any other expenses of terminating the Contract and having it completed by others. If the unpaid balance of the Contract Sum exceeds Owner's damages, including the costs of finishing the Work, compensation for additional design, managerial and administrative services,

any liquidated damages and any claims by Owner, together with any other expenses of terminating the Contract and having it completed by others, such excess shall be paid to the Contractor.

15.2.4 If it should be judicially determined that the Owner improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the Owner, with Contractor's recovery limited to what is allowed for a termination for convenience under the Contract Documents.

15.2.5 Termination of the Contract under this Section is without prejudice to any other right or remedy of the Owner.

15.3 OWNER'S RIGHT TO TERMINATE CONTRACT FOR CONVENIENCE

15.3.1 Owner may terminate this Contract, in whole or in part, at any time without cause upon giving the Contractor written Notice of such termination. Upon such termination, the Contractor shall immediately cease Work and remove from the site all of its labor forces and such of its materials and equipment as Owner elects not to purchase or to assume in the manner hereinafter provided. Upon such termination, the Contractor shall take such steps as Owner may require to assign to the Owner the Contractor's interest in all subcontracts and purchase orders designated by Owner. After all such steps have been taken to Owner's satisfaction, the Contractor shall receive as full compensation for termination and assignment the following:

- .1 Amounts due for Work performed in accordance with the Contract through the date of termination.
- .2 Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of such termination. The Contractor shall not be entitled to any compensation or damages for lost profits or for any other type of contractual compensation or damages other than those provided by the preceding sentence. Upon payment of the foregoing, Owner shall have no further obligations to Contractor of any nature.

15.3.2 In no event shall termination for the convenience of the Owner terminate the obligations of the Contractor's surety on its payment and performance bonds.

15.3.3 After receipt of a Notice of termination, the Contractor shall promptly submit to the Owner his termination claim. Such claim shall be submitted no later than forty-five (45) days from the effective date of termination. Upon failure of the Contractor to submit his termination claim within the time allowed, the Owner may determine, on the basis of information available to it, the amount, if any, due to the Contractor by reason of the termination.

15.4 CONTRACTOR'S RESPONSIBILITIES UPON TERMINATION

15.4.1 After receipt of a notice of termination pursuant to 15.3, Owner's Right to Terminate Contract for Convenience, the Contractor shall mitigate any damages to the extent reasonably possible.

15.4.2 In addition to the provisions of 15.4.1, the Contractor shall:

- .1 At the option of the Owner, assign to the Owner, in the manner, at the time, and to the extent directed by the Owner, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
- .2 Transfer title and deliver to the Owner in the manner, at the times, and to the extent, if any, directed by the Owner:

- a) The fabricated or un-fabricated parts, work in process, completed Work, supplies, and other material and equipment procured as a part of, or acquired in connection with the performance of the Work terminated by the Notice of Termination, and
 - b) The completed or partially completed drawings, releases, information, manuals and other property which, if the Contract had been completed, would have been required to be furnished to the Owner;
- .3 Complete performance of such part of the Work as shall not have been terminated by the Notice of Termination; and
- .4 Take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.



City of Lynchburg

**Wards Ferry Road
Pump Station Renovation**

Project No. 13033-W

Project Manual

Wiley|Wilson Commission No. 213038.00

June 21, 2013



City of Lynchburg

**Wards Ferry Road
Pump Station Renovation**

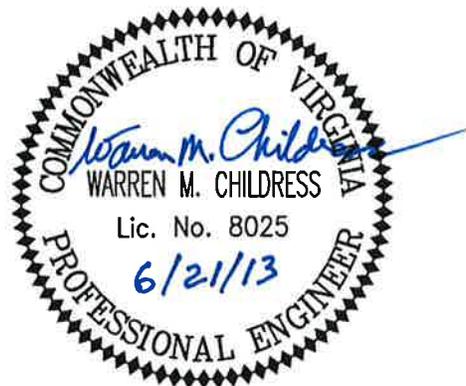
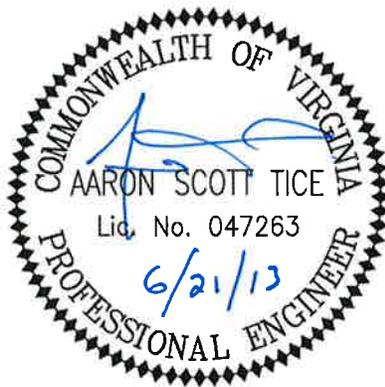
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June 21, 2013

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Modified Standard General Conditions govern procedures for “Substitute” or “Or-Equal” products. Where any inconsistencies exist between this Section and the Modified Standard General Conditions, the Modified Standard General Conditions shall have precedence.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 SUBMITTALS

- A. “Substitute” Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- B. “Or Equal” Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- C. Certificate of Proper Installation
- D. Certificate of Proper Operation

1.4 QUALITY ASSURANCE

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

- B. Inspection, field adjustment, and startup: Demonstrate that all equipment meets the specified performance requirement
- C. Manufacturer's Experience: Unless otherwise directed by the Engineer, all equipment furnished shall have a record of at least 5 years of successful, trouble free operation in similar applications, from the same manufacturer.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Contractor shall be responsible for the delivery, storage, and handling of products.
- C. Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry.
- D. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.
- E. Transport products by methods that prevent product damage. Deliver products dry and in undamaged condition in manufacturer's unopened containers or packaging. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- F. Load and unload equipment and appurtenances by hoists or skidding and in accordance with the manufacturer's recommendations. Do not drop products. Do not skid or roll products on or against other products. Utilize pad slings and hooks in a manner that prevents damage to products.
- G. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Store products that will be deteriorated by sunlight in a cool location out of direct sunlight. Rubber products shall not come in contact with petroleum products.
- H. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering and as recommended by manufacturer; provide ventilation that avoids condensation.
- I. Deliver pipe, fittings, valves, and accessories in a clean and undamaged condition. Store pipe, fittings, valves, and accessories off the ground and in accordance with manufacturer's instructions. Do not stack ductile iron pipe higher than the limits shown in ANSI/AWWA C600. Stacking of pipe shall meet the requirements of the pipe manufacturer. Do not stack fittings, valves, valve boxes, or valve stands.

- J. Keep stored products safe from damage or deterioration. Keep the interior of pipe, fittings, valves, and appurtenances free from dirt or foreign matter. Drain and store valves in a manner that will protect valves from damage. Store gaskets, plastic pipe and fittings, and other products that will be deteriorated by sunlight in a cool location out of direct sunlight.
- K. Equipment having moving parts such as gears, bearings, and electric motors; instruments; control panels; motor control centers; and switchgear shall be stored in a temperature and humidity controlled area until equipment is installed and permanent HVAC systems are in operation. Equipment with internal heaters shall be properly energized during storage up until the time they are installed.
- L. Stored electric motors and actuators with space heaters shall have the space heaters energized. When electric motors and actuators with space heaters are installed, the space heaters shall be connected and energized. Space heaters shall remain energized until equipment is accepted and placed in service.
- M. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.
- N. Promptly remove damaged products from the job site. Replace damaged products with undamaged products at no expense to Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
 - 2. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 - 3. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 5. Or Equal Products: In Accordance with Modified Standard General Conditions
 6. Substitute Products: In Accordance with Modified Standard General Conditions
 7. Comply with specifications and referenced standards as minimum requirements.
 8. All products shall be new and of the very best quality.
 9. Components that are supplied in quantity within a specification Section shall be the same, and shall be interchangeable.
 10. All parts of the equipment furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Or Equal Products" Article for consideration of an unnamed product.
 6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Or-Equal Products" Article for consideration of an unnamed product.
 7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Substitute Product Requests" Article for consideration of an unnamed product or system.

2.2 PRODUCT SUBSTITUTIONS

- A. All Substitute product requests shall be in accordance with the General Conditions.
- B. Timing: Engineer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.
- C. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. Substitution request is fully documented and properly submitted.
 - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.
 - 8. Requested substitution has been coordinated with other portions of the Work.
 - 9. Requested substitution provides specified warranty.
 - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
 - 11. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.

2.3 "OR EQUAL" PRODUCTS

- A. All Or Equal product requests shall be in accordance with the General Conditions.
- B. Conditions: Engineer will consider Contractor's request for "Or Equal" products when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require any revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
5. Samples, if requested.

2.4 MANUFACTURERS' CERTIFICATIONS

- A. Prior to delivery at project site, furnish an affidavit of compliance certified by the equipment manufacturer that the equipment and appurtenances furnished comply with all applicable provisions of applicable referenced standards and these specifications.
- B. Do not deliver equipment to job site until affidavit of compliance has been submitted and accepted by the Engineer.

2.5 NOISE AND VIBRATION

- A. Equipment that transmits vibration to structures, piping, conduit, or other items connected to the equipment, shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.
- B. Equipment that can be damaged by vibration generated by the equipment or by vibration transmitted through piping or other connecting items, shall be provided with vibration damping per manufacturer's written recommendations.

2.6 WELDING OF EQUIPMENT AND PIPE

- A. Shop Welding: Unless otherwise specified or shown, shop welding shall conform to the following:
 1. Applicable standards of the American Welding Society for the material and type of item being welded.
 2. All composite fabricated steel assemblies, which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.
 3. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS standards governing same.
 4. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

5. Field Welding: Field welding shall be as specified in individual specification Sections. Qualification of welders shall be in accordance with the AWS standards. Prior to commencement of any field welding, the Contractor shall furnish the Engineer a copy of each welder's current certification for the alloy, position and type of welding to be performed.

2.7 PROTECTIVE COATINGS FOR EQUIPMENT

- A. Equipment shall be painted or coated in accordance with relevant Section unless otherwise approved by the Engineer. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.
- B. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance.
- C. Shop-painted items which suffered damage to the shop coating shall be touched up as specified in the relevant Section.

2.8 GEARS AND GEAR DRIVES

- A. Unless otherwise specified, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA standards, with a minimum B-10 bearing life of 100,000 hours and a minimum efficiency of 94 percent. Gear reducer service factor shall be based on nominal motor horsepower and shall be:
 1. 2.0 for drives incorporating flexible connections between the driven shaft and the gear reducer.
 2. 2.5 for coupled drives with pinion gears incorporating a torsionally soft coupling between the motor and pinion shaft.
 3. 2.75 for integral gearmotors with pinion gears where the pinion is rigidly affixed to the motor shaft.
- B. For integral gearmotors with pinion gears, pinions shall not be of the shell type. The pinion gear shall be easily removable from the motor shaft in the field.
- C. Gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. Casings shall be of cast iron or heavy-duty steel construction with lifting lugs and an inspection cover for each gear train.
- D. Each oil lubricated gear speed reducer or increaser shall be provided with an oil level sight glass and an oil flow indicator, arranged for easy reading. Oil level and drain location relative to the mounting arrangement shall be easily accessible. Provide oil coolers, or heat exchangers, with required appurtenances when necessary to maintain the proper oil temperature for the application.

- E. Input and output shafts shall be designed for the service and load requirements of the equipment of which gear drives are a part. Gears shall be computer-matched for minimum tolerance variation. Each output shaft shall have seals that prevent lubricant leakage. Each oil lubricated gear drive output shaft shall have two positive seals.
- F. Where gear drive input or output shafts connect to couplings or sprockets not supplied by the gear drive manufacturer, the gear drive manufacturer shall supply matching key taped to the shaft for shipment.
- G. Ship gears and gear drives fully assembled for field installation.

2.9 DRIVE CHAINS

A. General:

- 1. Power drive chains shall be commercial type roller chains and meet ANSI standards.
- 2. Provide chain take-up or tightener that provides easy adjustment of chain tension.
- 3. Provide a minimum of one connecting or coupler link with each length of roller chain.
- 4. Chain and attachments shall be of the manufacturer's best standard material and suitable for the process fluid.

B. Sprockets:

- 1. Sprockets shall be used in conjunction with all chain drives and chain-type material handling equipment.
- 2. Unless otherwise specified, sprockets material shall be as follows:
 - a. Sprockets with 25 teeth or less, normally used as a driver, shall be made of medium carbon steel in the 0.40 to 0.45 percent carbon range.
 - b. Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be made of minimum 0.20 percent carbon steel.
 - c. Large diameter sprockets with Type C hub shall be made of cast iron conforming to ASTM A 48, Class 30.
- 3. Sprockets shall be accurately machined to ANSI standards. Sprockets shall have deep hardness penetration in tooth sections.
- 4. Finish bored sprockets shall be furnished complete with key seat and setscrews.
- 5. Sprockets shall be of the split type or shall be furnished with taper-lock bushings as required.
- 6. Idler sprockets shall be furnished with brass or babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with setscrews may be provided in both sides of the hub.

2.10 V-BELT DRIVES

- A. V-belts and sheaves shall be highest industrial grade and shall conform to ANSI and MPTA standards.

- B. Unless otherwise specified, sheaves shall be machined from gray cast iron.
- C. Sheaves shall be statically balanced. In some applications where vibration is a potential problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 feet per minute may be required to be of special materials and construction.
- D. Sheaves shall be furnished complete with taper-lock or QD bushings.
- E. Finish bored sheaves shall be furnished complete with key seat and setscrews.

2.11 DRIVE GUARDS

- A. Power transmission, prime movers, machines, and moving machine parts shall be guarded to conform to the OSHA Safety and Health Standards (29CFR1910).
- B. Where required for lubrication or maintenance, guards shall have hinged access doors.

2.12 BEARINGS

- A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).
- B. Fitting practice, mounting, lubrication, sealing, static rating, housing strength, and other factors shall be considered in bearing selection.
- C. Grease-lubricated type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.
- D. Install stainless steel tubing and supports as necessary to extend grease fittings so that greasing can be done from platforms and walkways used by the Owner in routine operations.
- E. Permanently lubricated bearings shall be factory-lubricated with the manufacturer's recommended lubricant.
- F. Except where otherwise specified or shown, bearings shall have a minimum B-10 life expectancy of 100,000 hours.
- G. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.
- H. Sleeve-type bearings shall have a babbitt or bronze liner.

2.13 SHAFTING

- A. Shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. Shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.
- B. Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as shown or specified, unless furnished as part of an equipment assembly.
 - 1. Low carbon cold-rolled steel shafting shall conform to ASTM A108, Grade 1018.
 - 2. Medium carbon cold-rolled shafting shall conform to ASTM A108, Grade 1045.
 - 3. Corrosion-resistant shafting shall be stainless steel or monel, whichever is most suitable for the intended service.
- C. Where differential settlement between the driver and the driven equipment may be expected, a shaft of sufficient length with two sets of universal type couplings shall be provided.
- D. All shafting shall be dynamically balanced in accordance with the recommendations of the shafting manufacturer.
- E. The Contractor shall furnish and install a heavy-duty shaft guard for all drive shafting which is less than seven feet above floor or platform level in accordance with the provisions of paragraph 1910.210 of OSHA Rules and Regulations. Provision shall be made in the guard as necessary for lubrication and inspection access of the joints and bearings without the necessity of removing the entire guard assembly.

2.14 COUPLINGS

- A. Flexible couplings shall be provided between the drivers and driven equipment. Flexible couplings shall accommodate angular misalignment, parallel misalignment, end float. Flexible couplings shall cushion shock loads.
- B. Equipment manufacturer shall select or recommend the size and type of coupling required to suit each specific application.
- C. Where required for vertical shafts, 3-piece spacer couplings shall be installed.
- D. Taperlock bushings may be used to provide for easy installation and removal on shafts of various diameters.
- E. Where universal type couplings are shown, they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

2.15 EQUIPMENT FOUNDATIONS

- A. Provide equipment foundations in accordance with equipment manufacturers' written instructions.
- B. Mount mechanical equipment, tanks, and floor mounted control cabinets on minimum 4" high reinforced concrete bases unless otherwise shown or specified.
- C. Submit foundation Drawings for review.

2.16 SHOP FABRICATION

- A. Perform shop fabrication in accordance with the final reviewed and processed Shop Drawings.

2.17 NAMEPLATES

- A. Equipment nameplates shall be stainless steel. Nameplates shall be engraved or stamped. Fasten nameplates to equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins.
- B. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.18 SPARE PARTS

- A. Following approval of the spare parts list by the Engineer and immediately prior to substantial completion, furnish spare parts suitably packaged for long-term storage and labeled with the date of supply, the equipment number and part number, equipment description and part description.

PART 3 - EXECUTION

3.1 MANUFACTURERS' REPRESENTATIVES

- A. Provide the services of experienced, competent, and authorized service representative of the manufacturer of the items of equipment when specified in the individual product Section.
- B. Manufacturers' representatives shall visit the site of work, and shall perform the following tasks:
 - 1. Assist Contractor in installation of equipment.
 - 2. Inspect, check, adjust equipment, and approve equipment installation.
 - 3. Startup and field-test equipment for proper operation, efficiency, and capacity. Perform necessary field adjustments during the test period until equipment installation and operation are satisfactory to the Engineer.
 - 4. Supervise Functional Tests as required in relevant Section.

5. Instruct Owner's personnel in operation and maintenance of equipment as specified in this Section.

C. The times specified in the individual product Sections for the manufacturer's representative to provide services are exclusive of travel time to and from the facility. The times specified shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

3.2 INSTALLATION

A. Install equipment in accordance with acceptable procedures submitted with the Shop Drawings and as indicated on the Drawings, unless otherwise accepted by the Engineer.

B. Measure drive shafts just prior to assembly to ensure correct alignment without forcing.

C. Support pipe, fittings, valves, conduit, and other items connected to equipment so that there are no excess stresses and loads on equipment.

D. Equipment shall be secure in position and neat in appearance.

3.3 LUBRICANTS

A. Furnish and install lubricants required for initial operation.

B. Maintain lubricants at proper levels until equipment is accepted.

C. Change lubricants in each piece of equipment following equipment initial run-in. The manufacturer shall test removed lubricants for metal particles and lubricant breakdown. Submit lubricant test report to the Engineer. If the equipment manufacturer requires the first lubricant change prior to final completion, the Contractor shall remove lubricant and furnish and install the necessary lubricants.

3.4 FIELD TESTS

A. Perform Field Tests of equipment/systems in accordance with relevant Sections.

3.5 FUNCTIONAL TEST

A. Prior to placing systems in service, perform Functional Test of equipment/systems in accordance with relevant Sections.

3.6 TRAINING

A. Manufacturer's representative, responsible Subcontractor, or both shall instruct Owner's designated operating and maintenance personnel in correct operation and maintenance procedures for equipment and systems when specified in individual product specification Sections. Qualified persons who have been made familiar in advance with equipment and systems at Owner's facility shall give on-site instruction.

- B. Submit to Engineer not less than 14 days prior to each training session an outline of the training program and the qualifications of the trainer(s).
- C. Coordinate training with the Owner. Notify Owner not less than 14 days in advance of each training session.
- D. Provide training while equipment is fully operational.
- E. Provide training for up to three separate shifts of Owner's personnel between the hours of 6:00 a.m. and 6:00 p.m. as necessary to accommodate Owner's personnel schedule. Duration of each training session shall be not less than two hours or more than six hours.
- F. Operation and maintenance data as specified in the relevant Section shall be submitted and accepted prior to commencement of training. Use accepted operation and maintenance manuals as the basis of instruction.
 - 1. Review contents of manual with personnel in full detail.
 - 2. Explain all aspects of operation and maintenance.
 - 3. Demonstrate startup, operation, control, adjustment, calibration, trouble-shooting, servicing, maintenance, and shutdown of equipment.

END OF SECTION

SECTION 017500 - TESTING AND STARTUP

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Procedures for starting of mechanical, electrical, control systems, and monitoring systems.

1.02 QUALITY CONTROL

- A. When specified in individual product Specification Sections, require manufacturer to provide authorized representative to be present at site at time of startup, testing, and training.
- B. Manufacturer's representative shall perform services as described in Section 016000, "Product Requirements."

1.03 SUBMITTALS

- A. Submit the following to the Engineer:
 - 1. Preliminary schedule listing times, dates and sequence for startup of each item of equipment fourteen (14) days prior to proposed dates.
 - 2. Manufacturer's representative reports within ten (10) days after testing.
 - 3. Each manufacturer shall prepare and submit a completed document, which is contained at the end of this Section, certifying the installation is acceptable and meets their standards and the equipment or device is functioning properly. The Contractor shall submit these certifications to the Engineer prior to either substantial completion or placing the equipment in service. A sample of the required certification document is appended to this Section 017500.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that project conditions comply with requirements.
- B. Verify that status of Work meets requirements for starting of equipment and systems.

3.02 PREPARATION

- A. Coordinate sequence for startup of various items of equipment.
- B. Notify Engineer fourteen (14) days prior to startup of each item of equipment.
- C. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire startup process.
- D. Provide control diagrams that show actual control components and wiring.
- E. Verify that each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, and other conditions that may cause damage.
- F. Verify control systems are fully operational in automatic and alternate modes of operation.
- G. Verify that tests, meter readings, and specific electrical characteristics agree with those specified by electrical equipment manufacturer.
- H. Verify that instruments, meters, and gauges have been calibrated. Perform three-point calibration on continuous elements and systems. Provide calibration records.
- I. Certificate of Proper Installation shall be issued by manufacturer to Engineer and Owner prior to initiating any startup activities.

3.03 STARTUP AND FUNCTIONAL TEST

- A. Perform startup prior to functional test.
 - 1. Perform pre-startup inspection of installation.
 - 2. Perform startup under no-load conditions, if possible. Observe noise, vibration, and operation.
 - 3. Owner and Engineer shall witness startup.
 - 4. If all operating characteristics are normal, proceed with startup.
- B. Perform functional test prior to placing equipment in service.
 - 1. Perform functional test under supervision of responsible manufacturers' representatives, instrumentation and control subcontractor, and Contractor personnel.
 - 2. Representatives of Owner and Engineer shall witness functional test.
 - 3. Perform functional test on each piece of equipment and operational system as specified in the individual product Sections.
 - 4. If system is to be placed in service in phases, perform functional test on each part of system prior to placing each part of system in service.
- C. Demonstrate that equipment operates and complies with specified performance requirements.

- D. Demonstrate that control panel functions, including failures and alarms, operate and comply with specified performance requirements.
- E. Functional test shall be non-destructive.
- F. If necessary, simulate failures and alarm conditions by jumping failure input terminals.
- G. Provide signal generators that simulate control conditions if it is not feasible to create actual conditions.
- H. Use actual as-built control diagrams in demonstration of functions.
- I. Use operation and maintenance manuals to demonstrate operation of equipment.
- J. If functional test does not meet requirements specified in this Section, Contractor shall compensate Engineer for additional time required to observe functional testing until system successfully completes functional testing.

3.04 TRAINING

- A. Comply with Section 016000, "Product Requirements."
- B. Comply with Section 018300, "Operation and Maintenance Data."

3.05 PLACING SYSTEMS IN SERVICE

- A. Complete functional testing prior to placing system in service.
- B. Require Certificate of Proper Installation.
- C. Require Certificate of Proper Operation.
- D. Execute startup under supervision of responsible manufacturer's representative and Contractor personnel.
- E. Place equipment in operation in proper sequence.

END OF SECTION

**Manufacturer's Certificate Of
Proper Installation**

Project _____

Date _____

Product: _____

Serial no.: _____

Specification Section: _____

As an authorized representative of the manufacturer, the undersigned certifies the product identified above has been inspected and is installed in accordance with the manufacturer's recommended standards, except as noted below.

Exceptions and comments:

Signature: _____

Printed name: _____

A copy of this executed certificate must be included in the operation and maintenance data. A copy must be forwarded to the Engineer upon completion of startup and testing.

**Manufacturer's Certificate Of
Proper Operation**

Project _____

Date _____

Product: _____

Serial no.: _____

Specification Section: _____

As an authorized representative of the manufacturer, the undersigned certifies the product identified above has been inspected and is installed in accordance with the manufacturer's recommended standards, except as noted below.

The undersigned further certifies that the product identified above has been placed into satisfactory operation and meets performance requirements of the Contract Documents, except as noted below.

Exceptions and comments:

Signature: _____

Printed name: _____

A copy of this executed certificate must be included in the operation and maintenance data. A copy must be forwarded to the Engineer upon completion of startup and testing.

SECTION 018300 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for content and submittal of manufacturers' operation and maintenance data and content and submittal of facility's operation and maintenance manual.

1.02 SUBMITTALS: MANUFACTURERS O&M DATA

- A. Draft: Submit three (3) draft copies of manufacturer's O&M data not later than shipment of product. Draft O&M data shall include binding. The Engineer will review and return two (2) copies with comments.
- B. Interim: Revise the manufacturer's O&M data based upon Engineer's comments and manufactured product. Submit four (4) copies of the manufacturer's O&M data within 30 days after product shipment and before product is placed in service.
- C. Final: Revise the manufacturer's O&M data based upon completed installation and any deficiencies noted during instruction of Owner's personnel. Submit six (6) copies of the complete, final O&M data. Submit final O&M data not more than 30 days after final inspection and startup.

1.03 CONTENTS, EACH VOLUME OF MANUFACTURER O&M DATA

- A. Table of Contents: Provide title of project; names, addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- B. For Each Product or System: List names, addresses, facsimile and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use project record documents as maintenance Drawings.
- E. Instructions: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Each manual shall comply with Parts 2.01.D through .G and 2.02 of this Section.
- G. Warranties and Bonds: Bind in copy of each.
- H. Additional Requirements: As specified in individual product Specification Sections.

1.04 DATA FOR MATERIALS AND FINISHES

- A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. (Provide information for re-ordering custom manufactured products.)
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

1.05 DATA FOR EQUIPMENT AND SYSTEMS

- A. Each Item of Equipment and Each System - provide the following:
 - 1. Product description
 - 2. Operating procedures
 - 3. Maintenance procedures
 - 4. Parts
 - 5. Lubricants
 - 6. Other specified data
- B. Manufacturer's Printed Operation and Maintenance Instructions: Provide manufacturer's printed operation and maintenance instructions.
- C. Control Data: Provide the following:
 - 1. Sequence of Operation by controls manufacturer
 - 2. Control diagrams by controls manufacturer as installed
- D. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.
- E. Drawings, Diagrams, and Charts: Provide the following:
 - 1. Color-coded wiring diagrams as installed
 - 2. Contractor's coordination Drawings, with color-coded piping diagrams as installed
 - 3. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams
- F. Tests and Reports: Include tests and reports as specified in the following contract including:
 - 1. Section 017500, "Testing and Startup".
 - 2. Division 02 through Division 33 – Individual product Specification Sections.

1.06 OPERATION AND MAINTENANCE DATA REQUIREMENTS

A. Product Description:

1. Identify each system and system component. Use identification numbers presented in the contract Drawings and Specifications.
2. Describe function, physical characteristics, normal operating characteristics, and alternate operating procedure.
3. Present performance curves, engineering data, and test results.
4. Describe operating limitations, environmental limitations, and any other limitations.

B. Operating Procedures:

1. Provide instructions, including required sequences, for the following operations:
 - a) Start-up following installation
 - b) Break-in
 - c) Routine
 - d) Preventative maintenance
 - e) Calibration
 - f) Emergency shutdown
 - g) Start-up following emergency shutdown
2. Provide operating procedures for variations in sunlight, temperature, and humidity.
3. Provide operating procedures for variations in demand, flow, and loading.
4. Provide special operating procedures vital to the product.

C. Maintenance Procedures:

1. Provide instructions for preventative, routine, and periodic maintenance, including the following:
 - a) Servicing and lubricating schedule and sequences
 - b) Wearing parts replacement schedule, including part numbers
 - c) Product disassembly and assembly
 - d) Alignment, adjustment, and testing
 - e) Product re-calibration
2. Provide a "troubleshooting" guide and repair instructions.

D. Parts:

1. Provide complete nomenclature for all product parts including manufacturer's part number for replacement parts.
2. Provide a list of recommended spare parts with instructions for storage of recommended spare parts.
3. Provide a list of local sources of supply for parts.

- E. Lubricants:
1. Provide a list of lubricants required. Identify the parts to be lubricated with each listed lubricant.
 2. Submit separate lubrication schedule for each piece of equipment.
 3. Other Data: Provide other operation and maintenance data as specified in the individual product Specification Sections.
- F. Other Data: Provide other operation and maintenance data as specified in the individual product Specification Sections.

PART 2 – PRODUCTS

2.01 GENERAL DESCRIPTION: FACILITY OPERATION AND MAINTENANCE MANUAL

- A. General: The Facility Operation and Maintenance Manual shall be a compilation of all manufacturer's O&M data. This data shall include all the data provided by the Contractor for the project. Each compilation shall be organized in binders by unit process.
- B. Binding:
1. The Facility Operation and Maintenance (O&M) Manual shall be bound in multiple binders. Binding by suppliers and manufacturers of their O&M data is acceptable if the binding meets the requirements of this Section. Contractor shall provide binding for O&M manual if the supplier does not provide binding which meets the requirements of this Section.
 2. Binding shall be 8-1/2-inch x 11-inch size. Binder capacity shall be not less than 2 inch or more than 3 inches.
 3. Binding shall be three-hole, left margin.
 4. Binders shall be three-ring, D-type.
 5. Binder covers shall be polyethylene, 110 mil thickness.
 6. Each binder shall be identified on the binder front and spine. Lettering and artwork shall be silkscreen applied to binders. Multiple volumes with the same identification shall be numbered sequentially using Arabic numerals. Binder data and copy of artwork shall be submitted to Engineer for approval.
- C. Table of Contents: Provide a detailed table of contents in each binder.
- D. Index of Tabs:
1. Provide a tabbed index sheet for each equipment item, component, or subject. Index tabs shall provide quick reference points, which assist the Owner's personnel in the use of the manual.
 2. Indexes shall be 90-lb. Stock, minimum. Tabs and binding strips shall be reinforced.

E. Text:

1. Text shall be legible and written in English. Each letter in the text shall be identifiable. Text shall be technically and grammatically correct.
2. Prepare the text so that operation and maintenance personnel can easily read, understand, and properly apply the instructions contained in the text. Arrange the text in a logical format. Use headings to identify each set of procedures.
3. Prepare text specific to this Project. Preprinted text and brochures may be used to supplement text specific to this Project if the text specific to this project contains reference, or references, to the preprinted material and if the preprinted material has been annotated to clearly show the part, or parts of the preprinted material that are applicable to this Project.
4. Text character height shall not be less than 8 points or more than 12 points. Larger size letters may be used for headings. Pitch shall be between 10 characters per inch and 16.66 characters per inch. The pitch may be less than 10 characters per inch in headings. Select character point and pitch to produce text, which is easy to read. Select a font style that is easy to read.

F. Illustrations:

1. Provide illustrations as required to clearly present instructions, clarify the text, or both. Place illustrations so that the illustrations are in a logical relationship to the text.
2. Pages of the O&M data may contain text, illustration, or text and illustrations. Preprinted illustrations and brochures containing illustrations may be used if the preprinted illustrations are applicable to this Project or the preprinted illustrations are annotated to clearly show the illustrations or parts of illustrations that are applicable to this Project.

G. Drawings:

1. Provide Drawings for each system in the O&M data. Drawings shall show the relationship between the various components in each system and the equipment installed in each system. If there is fluid flow within a system, the Drawings for the system shall include a flow diagram. If there is electrical power, control wiring, or both in a system, the Drawings for the system shall include a wiring diagram, a control diagram, or both as applicable.
2. Identify systems, components, and enclosures on the O&M data Drawings. Present definitions of all abbreviations and symbols used on the O&M data Drawings.
3. Identify wire and terminal numbers on all wiring diagrams.
4. Drawings shall be specific to this Project. Standard Drawings may be used in the O&M data if the Drawings are revised for this Project.

H. Quality Assurance:

1. Personnel who assemble the O&M data and the facility manual shall be familiar with requirements of this Section.
2. O&M data shall be written by, edited by, or written and edited by personnel skilled in technical writing to the extent required to communicate essential data.
3. Drawings, diagrams, figures, and illustrations shall be prepared by skilled draftsmen or CADD operators competent to prepare required Drawings.

2.02 REPRODUCTION

- A. Text and Drawings, sketches and diagrams used for illustrations shall be on 8-1/2-inch x 11-inch paper, 20-lb. Minimum. Do not use sensitized paper.
- B. Photo prints shall be securely mounted on 8-1/2-inch x 11-inch backing or shall be mounted in sheet protectors. Photo print backing shall be heavy paper, 90-lb. Minimum, card stock, or equal. Sheet protectors shall be non-glare, clear vinyl.
- C. Drawings shall be 8-1/2-inch x 11-inch, 11-inch x 17-inch, or larger. Drawings 8-1/2-inch x 11-inch and 11-inch x 17-inch shall be bound together with text and shall have reinforced holes. Drawings larger than 11-inch x 17-inch shall be folded and placed in pockets which are bound together with text or inside the back cover of the binder.
- D. Text and illustrations shall be originals, offset printed, photo prints, or first quality machine copies. Text and illustrations shall be crisp with a uniform background. If originals have characters, lines, or shading which is a color, or colors, other than black or the medium is a color, or colors other than white, provide machine color copies.
- E. Drawings shall be offset printed, blue line prints, black line prints, or first generation machine copies. Drawings shall be crisp with a uniform background. If originals have lines, characters, symbols, or shading which are a color, or colors, other than black, provide offset prints of Drawings.

PART 3 – EXECUTION

3.01 TRAINING OF OWNER'S PERSONNEL

- A. Fully instruct Owner's designated operating and maintenance personnel in the operations, maintenance, adjustment, and calibration of products, equipment, and systems if specified in the applicable Section of the Specifications.
- B. Use the O&M data as the basis of instruction.
 - 1. Review contents of manual with personnel in full detail.
 - 2. Explain all aspects of operation and maintenance.

END OF SECTION

SECTION 028310 - CHAIN LINK FENCES

PART 1 - GENERAL

- 1.01 DESCRIPTION: This Section specifies chain link type fencing, complete.
- 1.02 Reference specifications where applicable to Work under this Section are referred to by abbreviation as follows:
 - A. American Society for Testing and MaterialsASTM
 - B. Chain Link Fence Manufacturers Institute.....CLFMI
- 1.03 SUBMITTALS: Provide the following in a timely manner in accordance with the approved submittals Schedule as specified in Division 1 – “General Requirements.”
 - A. Submittal: Shop drawings of fence and gate components.

PART 2 - PRODUCTS

- 2.01 All tubular members shall be galvanized, Schedule 40 steel meeting requirements of ASTM A 53 for pipe and coating.
- 2.02 All structural and roll formed shapes shall be steel and shall meet requirements of ASTM A 53 for galvanized coatings. Structural and roll formed shapes shall be commercial quality or better weldable steel.
- 2.03 END, CORNER, AND PULL POSTS SHALL BE:
 - A. 3.50-inch by 3.50-inch roll-formed section weighing 5.14 pounds per linear foot or 2.875-inch OD pipe weighing 5.79 pounds per linear foot for fence up to and including 12 feet in height.
- 2.04 LINE POSTS SHALL BE:
 - A. 1.875-inch by 1.625-inch h-section weighing 2.70 pounds per linear foot, 1.875-inch by 1.625-inch c-section weighing 2.34 pounds per linear foot, or 1.90-inch OD pipe weighing 2.72 pounds per linear foot for fabric up to and including 6 feet in height.
- 2.05 SWING GATE POSTS SHALL BE:
 - A. 3.50-inch by 3.50-inch roll-formed section weighing 5.14 pounds per linear foot, or 2.875-inch OD pipe weighing 5.79 pounds per linear foot for gate leaves up to and including 6 feet wide.
 - B. 4-inch OD pipe weighing 9.11 pounds per linear foot for gate leaves over 6 feet and up to and including 13 feet wide.

- 2.06 Fit post tops with galvanized malleable iron fitting designed to exclude water from the post interior.
- A. The top shall be provided with a hole suitable for the through passage of the top rail.
- 2.07 Top rail shall be 1.628-inch by 1.25-inch roll-formed section weighing 1.35 pounds per linear foot, or 1.660-inch OD pipe weighing 2.27 pounds per linear foot furnished in standard lengths of approximately 20 feet with couplings approximately 6 inches long for each joint. One coupling in each five shall have an expansion spring.
- 2.08 A number 7 gauge coiled spring tension wire having a zinc coating of 1.6 ounces of zinc per square foot of surface area shall be provided along bottom of fence. Tension wire shall meet the requirements of ASTM A 641 Class 3B.
- 2.09 BRACING AND TENSIONING
- A. Bands shall be unclimbable, beveled edge type, secured with 0.375-inch diameter square shouldered aluminum carriage bolts, nonremovable from outside of fence enclosure.
- B. All terminal posts shall have 1.625-inch by 1.25-inch roll-formed section weighing 1.35 pounds per linear foot or 1.660-inch OD pipe weighing 2.27 pounds per linear foot. Horizontal compressive member braces shall be attached to terminal and first line posts with malleable iron fittings and bevel edge bands. Provide 0.375-inch diameter rod and turnbuckle truss braces from first line post to bottom of terminal post. Terminal posts include end, corner, pull, and gate posts.
- C. Tension bars (stretcher bars) for attaching fence fabric to terminal posts shall be 0.25- by 0.75-inch high carbon steel, and shall be attached to terminal posts by means of beveled edge bands. Stretcher bars shall be one piece lengths equal to full height of fabric.
- 2.10 Intermediate and corner posts shall be equipped with extension arms for the support of barbed wire. The arm base shall be malleable iron and the extension shall be pressed steel, the complete units being hot galvanized after fabrication. Intermediate post arms shall have provision for accommodating the top rail, and the corner post arms shall have a set screw.
- A. Arms shall slope to the outside at a 45 degree angle.
- 2.11 FABRIC
- A. Fencing fabric shall consist of individual wire pickets, helically wound, and interwoven from 9 gauge, (0.148 inches) 1,290-pound break load, copper bearing steel wire to form a continuous chain link fabric in 2-inch mesh. Top and bottom edges of fabric shall have a twisted and barbed finish, and fabric shall be 8 feet in height between top and bottom edges, exclusive of barbed wire brackets. The fabric shall meet the requirements of the applicable portions of ASTM A 392.
- B. Fence fabric edging shall be barbed top and bottom.

- C. Fabric shall be hot dip galvanized after weaving and the zinc coating shall not be less than ASTM A 392, Class 1. The coating shall withstand six 1 minute dips by the Preece test, ASTM A 239.
 - D. The wire in the completed fabric shall have a tensile strength of not less than 80,000 psi.
- 2.12 Barbed wire shall meet requirements of ASTM A 121. Each strand shall consist of two 12-1/2 gauge twisted copper bearing, 0.20 percent copper, steel line wires, double galvanized, ASTM A 121, Class 2, having 14 gauge four point barbs spaced 5 inches apart.
- 2.13 GATES, FRAMES, AND HARDWARE
- A. Swing gate frames shall be 1.90-inch OD pipe weighing 2.72 pounds per linear foot with interval bracing of 1.660-inch OD pipe weighing 2.27 pounds per linear foot. Frame members shall be welded at all joints to insure a watertight construction.
 - B. Fabric for gates shall be as specified for line fence.
 - C. Hinges shall be standard offset type which will allow gates to swing back parallel with line fence. Hinge material shall be malleable iron or steel forgings.
 - D. Double latches shall be drop-bar type, securely bolted to gate frames, and designed to engage heavy malleable iron gate stops anchored in concrete footings.
 - E. Single latches for gate frames up to and including 10 feet wide, shall be malleable iron, gravity type, designed to automatically engage a pin welded to the gate frame and to be secured with an approved type padlock.
 - F. Gate Keepers: Gates shall be equipped with a gate keeper designed to engage with the gates when opened wide to secure them in this position.
 - H. Provide diagonal cross-bracing consisting of 0.375-inch diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.
- 2.15 Miscellaneous Fittings: All fence fittings as above or otherwise necessary for a complete installation shall be malleable iron, pressed steel, aluminum, or forgings. All miscellaneous ferrous metals used in the Work shall be hot dip galvanized in accordance with ASTM A 153.
- 2.16 Wire Ties: For tying fabric to line posts, use 6 gauge steel wire clips for c-section or h-section posts and minimum 9 gauge aluminum or steel wire ties for tubular posts. For tying fabric to rails and braces, use 9 gauge aluminum wire ties. For tying fabric to tension wire, use 11 gauge pig rings.
- 2.17 Center rails between line posts shall be 1.660 OD pipe weighing 2.27 pounds per linear foot for fabric over 12 feet in height.

PART 3 - EXECUTION

- 3.01 Space posts not more than 10 feet apart.
- 3.02 Encasement: Encase the posts at least 3 feet in concrete footings with a minimum of 6 inches of concrete below the bottom of the post. Provide encasement 10 inches in diameter for line posts, 12 inches in diameter for end, corner, and pull posts, and 10-inches plus the od of the gate post in diameter for gate posts. Extend top of encasements 2 inches above ground line at post, and slope top to drain.
- 3.03 Where rock is encountered, drill holes 2 inches deeper than required 3 feet. Drill the holes 2 inches greater than the outside diameter of the post or the greatest dimension of the h-section. Then fill in the hole around the post with a one to three grout of cement and concrete sand. Complete encasement of the post as specified in article, "Encasement."
- 3.04 Brace terminal posts with specified horizontal compressive member, and truss braces and fittings.
- 3.05 Brace corner posts in each direction with bracing specified for terminal posts.
- 3.06 Brace straight runs at not more than 500 foot intervals and each vertical angle point of 15 degrees or more with bracing specified for terminal posts. Install corner posts at each horizontal angle point.
- 3.07 Install fence fabric uniformly at a distance of 2 inches above the ground.
- 3.08 Fasten fabric to top rail with wire ties and bottom tension wire with pig rings at intervals of 2 feet.
- 3.09 Attach fabric to all posts at intervals of not more than 14 inches and on the outside of the posts in relation to the enclosed area.
- 3.10 Bend ends of wire ties to minimize hazards to persons or clothing.
- 3.11 Attach stretcher bars to terminal posts with beveled edge bands.
- 3.12 Install three parallel barbed wires on the top of each 45-degree extension arm, unless otherwise shown. Pull wire taut.
- 3.13 BARBED WIRE:
- A. Outrigger: Install outriggers (extension arms) as recommended by the manufacturer, and in accordance with these specifications. Securely anchor supporting arms to posts in such a manner that shall prevent easy removal with hand tools. Studs driven by low-velocity powder actuated tools may be used with steel, wrought iron, ductile irons, or malleable iron.
 - B. Install barbed wire and all necessary accessories as shown on the drawings and described in this Section.

- C. Barbed wire shall be stretched tight through the outer slot only, of each extension arm and secured as required.
- 3.14 Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate when necessary.
- 3.15 Install gate stops so that the plunger can be fully engaged.
- 3.16 Install nuts for tension band and hardware bolts on side of fence opposite fabric side.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Material certificates.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- D. Owner will engage an inspection company to inspect sub-grade compaction, form work, rebar steel, and to perform slump and air testing. Contractor shall notify Owner at least 14 calendar days in advance of need for inspection.

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. 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.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
 - 1. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II.
 - a. Fly Ash: ASTM C 618, Class F
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Normal-Weight Aggregates: ASTM C 33, graded.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.6 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture 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 heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa)
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45
 - 3. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size for all concrete unless indicated otherwise.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, 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.

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 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. Chamfer exterior corners and edges of permanently exposed concrete.

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.

3.3 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 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.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- 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: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). 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- (3.2-mm-) wide joints into concrete when 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.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal 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 indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. 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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view.
- 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.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, reststraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated.

- C. 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 restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling 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. Apply a trowel finish to surfaces exposed to view.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 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.
 - 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.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 - 4. 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.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION

SECTION 036000 - GROUT

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. ASTM International (ASTM):
 - a. C230, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
 - b. C 1107, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink).
2. Corps of Engineers (COE):
 - a. CRD-C611, Flow of Grout for Preplaced Aggregate Concrete.
 - b. CRD-C621, Specification for Nonshrink Grout.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data of grouts.
2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
3. Forming method for fluid grout placements.
4. Curing method for grout.

B. Informational Submittals:

1. Manufacturer's Written Instructions:
 - a. Adding fiber reinforcing to batching.
 - b. Cement-water ratio of grout topping.
 - c. Mixing of grout.
2. Manufacturer's proposed training schedule for grout work.
3. Manufacturer's Certificate of Compliance:
 - a. Grout free from chlorides and other corrosion-causing chemicals.
 - b. Nonshrink grout properties of Categories II and III, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
4. Manufacturer's Certificate of Proper Installation.
5. Statements of Qualification: Nonshrink grout manufacturer's representative.

6. Test Reports:

- a. Test report for 24-hour evaluation of nonshrink grout.
- b. Test results and service report from demonstration and training session.
- c. Field test reports and laboratory test results for field-drawn Samples.

1.03 QUALIFICATIONS

- A. Nonshrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of one (1) year experience that has resulted in successful installation of grouts similar to those for this Project.
- B. For grout suppliers not listed herein, provide completed 24-hour Evaluation of Nonshrink Grout Test Form, attached at the end of this Section. Independent testing laboratory to certify that testing was conducted within last 18 months.

1.04 GUARANTEE

- A. Manufacturer's guarantee shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.
- B. Manufacturer guarantees participation with Contractor in replacing or repairing grout found defective due to faulty materials, as determined by industry standard test methods.

PART 2 - PRODUCTS

2.01 NONSHRINK GROUT SCHEDULE

- A. Furnish nonshrink grout for applications in grout category in the following schedule:

Application	Temperature Range	Max. Placing Time	
		20 min	Greater than 20 min.
Filling tie holes	I	I	I
Blockouts for gate guides	I or II		II
Precast joints	I or II		II
Column baseplates single-story	I or II		II
Machine bases 25 hp or less	II	II	II
Bases for precast wall sections	II	II	II
Baseplates for columns over one story	II	II	II
Precast base joints higher than one story	II	II	II

	<u>Temperature Range</u>	<u>Max. Placing Time</u>	
Application	40 to 100 deg F	20 min	Greater than 20 min.
Through-bolt openings	II	II	II
Machine bases 26 hp and up	III	III	III
Baseplates and/or soleplates with vibration, thermal movement, etc.	III	III	III

2.02 NONSHRINK GROUT

A. Category I:

1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in Accordance with ASTM C1107:
 - a. Flowable consistency 140 percent, five drops in 30 seconds, in accordance with ASTM C230.
 - b. Flowable for 15 minutes.
4. Grout shall not bleed at maximum allowed water.
5. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
6. Manufacturers and Products:
 - a. Chemrex, Inc., Shakopee, MN; Set Grout.
 - b. Euclid Chemical Co., Cleveland, OH; NS Grout.
 - c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
 - d. US MIX Products, Denver, CO; US Spec Multi-Purpose Grout.
 - e. L&M Construction Chemicals, Inc., Omaha, NE; Duragrout.

B. Category II:

1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in Accordance with COE CRD-C621 and ASTM C1107, Grade B:
 - a. Fluid consistency .20 to 30 seconds in accordance with COE CRD-C611.
 - b. Temperatures of 40, 80, and 100 degrees F.
5. One hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
7. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.

8. Manufacturers and Products:

- a. Chemrex, Inc., Shakopee, MN; Master Flow 928.
- b. Five Star Products Inc., Fairfield, CT; Five Star 100.
- c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
- d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
- e. L&M Construction Chemicals, Inc., Omaha, NE; Crystex.

C. Category III:

1. Metallic and nongas-liberating.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in Accordance with COE CRD-C621 and ASTM C1107, Grade A:
 - a. Fluid consistency 20 to 30 seconds in accordance with COE CRD-C611.
 - b. Temperatures of 40 and 100 degrees F.
5. One hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
7. Maintain fluid consistency when mixed in 1 to 9 yard loads in ready-mix truck.
8. Manufacturer and Product:
 - a. Chemrex, Inc., Shakopee, MN; EMBECO 885.
 - b. L & M Construction Chemicals, Inc., Omaha, NE; Ferrogrout.

PART 3 - EXECUTION

3.01 NONSHRINK GROUT

- A. General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative's training instructions.
- B. Form Tie or Through-Bolt Holes: Provide nonshrink grout, Category I and II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes, coordinate dry pack dense grout application with vinyl plug in Section 033000, "Cast-in-Place Concrete."
- C. Grouting Machinery Foundations:
 1. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material.
 2. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts.
 3. Form with watertight forms at least 2 inches higher than bottom of plate.

4. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions.

3.02 FIELD QUALITY CONTROL

A. Evaluation and Acceptance of Nonshrink Grout:

1. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
2. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with COE CRD-C621.
3. For large grout applications make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
4. Consistency: As specified in Article Nonshrink Grout. Grout with consistencies outside range requirements shall be rejected.
5. Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates shall be rejected.
6. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.
7. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
8. Perform bleeding test to demonstrate grout will not bleed.
9. Store cubes at 70 degrees F.
10. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with COE CRD-C621.

3.03 MANUFACTURER'S SERVICES

A. General:

1. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer's representative.
2. Provide and conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of nonshrink grout.
3. Necessary equipment and materials shall be available for demonstration.

B. Training:

1. Training is required for all Type II and Type III grout installations.
2. Grout manufacturer's representative shall train Contractor to perform grout work.
3. Establish location at Site and schedule time for grout manufacturer's demonstration and training session of proposed nonshrink grouts. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, e.g., baseplates and tie holes to provide actual on-the-job training.
4. Use minimum of five bags for each grout Category II and Category III. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1, 3, and 28 days. Use remaining grout for final Work.

5. Training shall include methods for curing grout.
6. Mix and demonstrate patching through-bolt holes and blockouts for gate guides, and similar items.
7. Transport test cubes to independent test laboratory and obtain test reports.

3.04 SUPPLEMENTS

- A. The supplement listed below, following "END OF SECTION," is part of this Specification.
 1. 24-hour Evaluation of Nonshrink Grout Test Form and Grout Testing Procedures.

END OF SECTION

SUPPLEMENT 1

(Test Lab Name)

(Address)

(Phone No.)

24-HOUR EVALUATION OF NON-SHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain two (2) bags of each type of grout:

1. From intended grout supplier for Project.
2. Two bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

- A. Product data and warranty information contained in company literature and data? Y__/N__
- B. Literature and bag information meet specified requirements? Y__/N__
- C. Manufacturer guarantees grout as specified in Article Guarantee? Y__/N__
- D. Guarantee extends beyond grout replacement value and allows participation with Contractor in replacing and repairing defective areas? Y__/N__
- E. Water demands and limits printed on bag? Y__/N__
- F. Mixing information printed on the bag? Y__/N__
- G. Temperature restrictions printed on bag? Y__/N__

*Rejection of a grout will occur if one or more answers are noted NO.

GROUT TESTING PROCEDURES

A. Bagged Material:

1. List lot numbers. _____
2. List expiration date. _____
3. Weigh bags and record weight. _____

Engineer will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of two bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in 10 gallon pail.
2. Use electric drill with a paddle device to mix grout (Giffy or Jiffler type paddle).
3. Use maximum water allowed per water requirements listed in bag instructions.
4. Mix grout to maximum time listed on bag instructions.
5. In accordance with CaE CRD-C611 (flow cone) determine time of mixed grout through the flow cone. _____ seconds
6. Add water to attain 20 to 30 second flow in accordance with CaE CRD-C611.
7. Record time of grout through cone at new water demand. _____ seconds.
8. Record total water needed to attain 20 to 30 second flow. _____ pounds.
9. Record percent of water. _____ percent.

C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, CaE CRD-C621 will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:

1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
3. Cover top of both cans with glass or plastic plate preventing evaporation.
4. Maintain 38 to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
5. Visually check for bleeding of water at 15-minute intervals for 2 hours.
6. Perform final observation at 24 hours.

If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and III):

1. Divide the remaining grout into two (2) 3-gallon cans. Place the cans into the 40-degree F and 100-degree F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4 inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.
2. Right after the settlement test mix the grout with the drill mixer for 10 seconds.

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Aluminum framing and supports, stair, railing and grating for mechanical and electrical equipment access platform.
 2. Miscellaneous metal fabricated equipment.
- B. Structural Performance of Stairs and Platforms: Structures shall withstand the effects of gravity loads and all other loads for equipment shown on the Drawings and Specifications within the limits and under conditions indicated. The following represent minimum loads and stresses.
1. Uniform Load: 100 lbf/SF.
 2. Concentrated Load: 300 LBS or an area load of 50 PSF. Design for added equipment load of 120 PSF.
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- D. Seismic Performance: Structures shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor is 1.5.

1.2 SUBMITTALS:

- A. Shop Drawings - Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. Provide templates for anchors and bolts specified for installation under other sections.

- B. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For qualified professional engineer registered in the Commonwealth of Virginia.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code Steel."
 - 2. AWS D1.2 "Structural Welding Code Aluminum"
 - 3.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on shop drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.5 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- B. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304.
- C. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.
- D. W-Shapes: ASTM A992.
- E. Steel Tubing: ASTM A 500, Cold-Formed Steel Tubing.
- F. Steel Pipe: ASTM A 53/A 53M, standard weight (schedule 40), unless another weight is indicated or required by structural loads.
- G. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required.
- H. Aluminum, Structural Shapes, and Plates: ASTM B209 and ASTM B308 Alloy 6061-T6.
- I. Aluminum Bolts and Nuts: ASTM F468 Alloy 2024-T4.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, alloy group 1 (A1).
- D. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
 - 2. Unless otherwise stated, all anchor bolts shall be the requirements of the preceding subsection. Galvanized bolts shall not be painted unless specifically required in the contract documents.
- E. Plain Washers: Round, ASME B18.22.1 (ASME B18.22m).
- F. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- G. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M Malleable Iron or ASTM A 27/A 27M Cast Steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class FE/ZN 5.
 2. Material for Anchors in Exterior Locations: Alloy Group 2 (A4) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with relevant Section or provide Manufacturer's Standard Coating as approved by Engineer.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Concrete Materials and Properties: Comply with requirements in Section 033000, "Cast-In-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 mpa), unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other sections as needed to complete the work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit UNO.

- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.8 STEEL WARE ANGLES AT DOOR OPENINGS

- A. Provide galvanized steel angles as indicated with anchor lugs for securing to cast-in-place concrete or masonry as required. Provide full length of door openings.

2.9 FINISHES, GENERAL

- A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

2.11 ALUMINUM GRATING

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
 - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. 6061-T1, for grating crossbars.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with

edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Aluminum:

1. Fabricate and erect in accordance with the Aluminum Association Standards and manufacturers recommendations as approved.
2. Grind smooth sheared edges exposed in finished work.
3. Do not remove mill markings from concealed surfaces.
4. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

D. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, and other connectors.

F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint as recommended by Manufacturer and approved by Engineer.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 FIELD QUALITY CONTROL

- A. Owners independent testing agency shall perform inspections according to chapter 17 of the 2009 International Building Code. Defective welds, bolts, nuts and washers shall be reported together with information on how they were remedied.

END OF SECTION

SECTION 055300 - METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal bar gratings.
 - 2. Metal frames and supports for gratings.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications"

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Fabricated steel bar gratings
 - 2. Clips and anchorage devices for gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- B. Wire Rod for Bar Grating Crossbars: ASTM A 510.

2.2 FASTENERS

- A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, or ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- B. Plain Washers: Round, ASME B18.22.1.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 - 2. Fabricate toeplates for attaching in the field.
 - 3. Toeplate Height: 4 inches unless otherwise indicated.

2.5 METAL BAR GRATINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - 2. All American Grating.
 - 3. BarnettBates Corporation.
 - 4. Borden Metal Products (Canada) Limited.
 - 5. Fisher & Ludlow; Division of Harris Steel Limited.
 - 6. Grating Pacific, Inc.
 - 7. Grupo Metelmex, S.A. de C.V.
 - 8. IKG Industries; a division of Harsco Corporation.
 - 9. Marwas Steel Co.; Laurel Steel Products Division.
 - 10. Ohio Gratings, Inc.
 - 11. Seidelhuber Metal Products; Division of Brodhead Steel Products.
 - 12. Other approved manufacturers.
- B. Welded Steel Grating:
 - 1. NAAMM: Type W-19-4
 - 2. Bearing Bar Spacing: 1-3/16 inches o.c.
 - 3. Bearing Bar Depth: as indicated
 - 4. Bearing Bar Thickness: as indicated

5. Crossbar Spacing: 4 inches o.c.
 6. Steel Finish: Galvanized
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- D. Do not notch bearing bars at supports to maintain elevation.

2.6 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
1. Unless otherwise indicated, fabricate from same basic metal as gratings.

2.7 STEEL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish gratings, frames, and supports after assembly.
- C. Provide galvanized grating.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Fit exposed connections accurately together to form hairline joints.
1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- D. Attach toeplates to gratings by welding at locations indicated.

- E. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.
- D. Repair damaged galvanizing with approved zinc-rich paint.

END OF SECTION 055300

SECTION 099000 - PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this Section:
1. American National Standards Institute (ANSI):
 - a. Standard Colors for Color Identification and Coding.
 - b. ANSI 13.1, Scheme for the Identification of Piping Systems.
 2. Occupational Safety and Health Act (OSHA).
 3. The Society for Protective Coatings (SSPC):
 - a. SP 1, Solvent Cleaning.
 - b. SP 2, Hand Tool Cleaning.
 - c. SP 3, Power Tool Cleaning.
 - d. SP 5, Joint Surface Preparation Standard White Metal Blast Cleaning.
 - e. Cleaning.
 - f. SP 6, Joint Surface Preparation Standard Commercial Blast Cleaning.
 - g. Cleaning.
 - h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
 - i. SP 10, Joint Surface Preparation Standard Near-White Blast Cleaning.
 - j. SP 11, Power Tool Cleaning to Bare Metal.
 - k. SP12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating.
 - l. SP 13, Surface Preparation of Concrete.
 - m. PA 1, Shop, Field, and Maintenance Painting.
 - n. P A 2, Measurement of Dry Coating Thickness with Magnetic Gauges.
 - o. P A 3, Guide to Safety in Paint Applications.

1.02 DEFINITIONS

- A. Terms used in this Section:
1. Coverage: Total minimum dry film thickness in mils or SF per gallon.
 2. FRP: Fiberglass Reinforced Plastic.
 3. HCl: Hydrochloric Acid.
 4. MDFT: Minimum Dry Film Thickness, mils.
 5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
 6. Mil: Thousandth of an inch.
 7. PSDS: Paint System Data Sheet.
 8. PVC: Polyvinyl Chloride.
 9. SFPG: SF per Gallon.
 10. SFPGPC: SF per Gallon per Coat.
 11. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

- a. For each paint system, furnish a Paint System Data Sheet (PSDS), the manufacturer's technical data sheets, and paint colors available (where applicable) for each product used in paint system.
- b. Technical and performance information that demonstrate compliance with Specification.
- c. Submit required information on a system-by-system basis.
- d. Furnish copies of paint system submittals to the coating applicator.

B. Informational Submittals:

1. Applicator's Qualification: List of references substantiating experience.
2. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
3. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.
4. Manufacturer's written instructions and special details for applying each type of paint.
5. Manufacturer's written verification that submitted material is suitable for the intended use.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
 - a. Paint manufacturer's instructions.
 - b. SSPC P A 3, Guide to Safety in Paint Applications.
 - c. Federal, state, and local agencies having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.

2. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.
2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.
- B. Minimum of 5 years of verifiable experience in manufacture of specified product.

2.02 ABRASIVE MATERIALS

- A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service.
2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Acrylic Latex	Single-component, finish as required
Acrylic Latex (Flat)	Flat latex
Acrylic Sealer	Clear Acrylic
Alkyd (Semigloss)	Semigloss Alkyd
Alkyd Enamel	Optimum quality, gloss or semi-gloss finish as required, medium long oil
Alkyd Wood Primer	Flat Alkyd
Bituminous Paint	Single-component, coal-tar pitch based
Block Filler	Primer sealed designed for rough masonry surfaces, 1005 acrylic emulsion
Coal-Tar Epoxy	Amine, polyamide, or phenolic epoxy type 70% volume solids minimum, suitable for immersion service
Elastomeric Polyurethane	100% solids, plural component, spray applied, high build, elastomeric polyurethane coating, suitable for the intended service
Epoxy Filler/Surfacer	100% solids epoxy trowel grade filler and surfacer, non shrinking, suitable for application to concrete and masonry. Approved for potable water contact and conforming to NSF 61, where required
Epoxy Nonskid (Aggregated)	Polyamide or amine converted epoxies aggregated; aggregate may be packaged separately
Epoxy Primer - Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments
Epoxy Primer - Other	Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
Fusion Bonded Coating	100% solids, thermosetting, fusion bonded, dry powder epoxy or polyurethane resin, suitable for the intended service
Fusion Bonded, TFE Lube or Grease Lube	Tetrafluoroethylene, liquid coating, or open gear grease as supplied by McMaster-Carr Supply Corporation., Elmhurst, IL; RL 736 manufactured by Amrep, Inc., Marietta, GA
High Build Epoxy	Polyamide or polyamidoamine epoxy, minimum 69% volume solids, capability of 4 to 8 MDFT per coat
Inorganic Zinc Primer	Solvent or water based, having 85% metallic zinc content in the dry film; follow manufacturer's recommendation for topcoating

Product	Definition
Latex Primer Sealer	Waterborne vinyl acrylic primer/sealer for interior gypsum board and plaster. Capable of providing uniform seal and suitable for use with specified finish coats
NSF Epoxy	Polyamide epoxy, approved for potable water contact and conforming to NSF 61
Epoxy, High Solids	Polyamide or polyamidoamine epoxy, 80% volume solids, minimum, suitable for immersion service
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish
Rust-Inhibitive Primer	Single-package steel primers with anticorrosive Pigment loading
Sanding Sealer	Co-polymer oil, clear, dull luster
Silicone/Silicone Acrylic	Elevated temperature silicone or silicone/acrylic based
Stain, Concrete	Acrylic, water repellent, penetrating stain
Stain, Wood	Satin luster, linseed oil, solid or transparent as required
Varnish	Nonpigmented vehicle based on a variety of resins (alkyd, phenolic, urethane) in gloss, semigloss, or flat finishes, as required
Water Base Epoxy	Two-component, polyamide epoxy emulsion, finish as required

2.04 MIXING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Furnish small quantity kits for touchup painting and for painting other small areas.
5. Mix only components specified and furnished by paint manufacturer.
6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference paragraph Shop Coating Requirements, this Section.

B. Shop Coating Requirements:

1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.
2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Painting subcontractor shall perform the Work only in presence of Contractor, unless Contractor grants prior approval to perform the Work in Contractor's absence.

3.02 EXAMINATION

A. Factory-Finished Items:

1. Schedule inspection with Engineer before repairing damaged factory-finished items delivered to Site.
2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

- B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.
- B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.
- C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.
- D. Mask openings in motors to prevent paint and other materials from entering.
- E. Protect all surfaces adjacent to, or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. Shop Blast Cleaning:

1. Structural steel, metal doors and frames, metal louvers, and similar items as reviewed by Engineer, may be shop prepared and primed. Centrifugal wheel blast cleaning is an acceptable alternate to shop blast cleaning.

B. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
2. Refer to coating systems for degree of abrasive blasting required.
3. Where the specified degree of surface preparation differs from manufacturer's recommendations, the more stringent shall apply.

C. Metal Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:
 - a. SP1, Solvent Cleaning: Removal of all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
 - b. SP2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
 - c. SP3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
 - d. SP5, White metal Blast Cleaning: Removal of all visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
 - e. SP6, Commercial Blast Cleaning: Removal of all visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
 - f. SP7, Brush-Off Blast Cleaning: Removal of all visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.
 - g. SP8: Pickling.
 - h. SP10, Near-White Blast Cleaning: Removal of all visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.

- i. SP11, Power Tool Cleaning to Bare Metal: Removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.
 - j. SP12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating: Surface preparation using high- and ultrahigh pressure water jetting to achieve specified surface cleanliness condition. Surface cleanliness conditions are defined in SSPC SP12 and are designated WJ-1 through WJ-4 for visual surface preparation definitions and SC-1 through SC-3 for nonvisual surface preparation definitions.
2. The words "solvent cleaning," "hand tool cleaning," "wire brushing," and "blast cleaning," or similar words of equal intent in these Specifications or in paint manufacturer's specification refer to the applicable SSPC Specification.
 3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply.
 4. Hand tool clean areas that cannot be cleaned by power tool cleaning.
 5. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
 6. Welds and Adjacent Areas:
 - a. Prepare such that there is:
 - 1) No undercutting or reverse ridges on weld bead.
 - 2) No weld spatter on or adjacent to weld or any area to be painted.
 - 3) No sharp peaks or ridges along weld bead.
 - b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
 7. Preblast Cleaning Requirements:
 - a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
 - b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
 - c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
 8. Blast Cleaning Requirements:
 - a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.
 - b. Select type and size of abrasive to produce surface profile that meets coating manufacturer's recommendations for particular primer to be used.
 - c. Use only dry blast cleaning methods.

- d. Do not reuse abrasive, except for designed recyclable systems.
 - e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.
9. Post-Blast Cleaning and Other Cleaning Requirements:
- a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
 - b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.
- D. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:
1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.
 2. Remove oil and grease by wiping or scrubbing surface with suitable solvent, rag, and brush. Use clean solvent and clean rag for final wiping to avoid contaminating surface.
 3. Obtain and follow coating manufacturer's recommendations for additional preparation that may be required.
- E. Concrete Surface Preparation:
1. Do not begin until 30 days after concrete has been placed.
 2. Follow SSPC SP 13.
 3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
 4. Brush-off blast clean to remove loose concrete and laitance, and provide a tooth for binding. Upon approval by Engineer, surface may be cleaned by acid etching method. Approval is subject to producing desired profile equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or overhead surfaces shall not be allowed.
 5. Secure coating manufacturer's recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.
 6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.
- F. Masonry Surface Preparation:
1. Complete and cure masonry construction for 14 days or more before starting surface preparation work.
 2. Remove oil, grease, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent washing, or other suitable cleaning methods.

3. Clean masonry surfaces of mortar and grout spillage and other surface deposits using one of the following:
 - a. Nonmetallic fiber brushes and commercial muriatic acid followed by rinsing with clean water.
 - b. Brush-off blasting.
 - c. Water blasting.
 4. Do not damage masonry mortar joints or adjacent surfaces.
 5. Leave surfaces clean and, unless otherwise required for proper adhesion, dry prior to painting.
 6. Masonry Surfaces to be Painted: Uniform texture and free of surface imperfections that would impair intended finished appearance.
 7. Masonry surfaces to be Clear Coated: Free of discolorations and uniform in texture after cleaning.
- G. Wood Surface Preparation:
1. Replace damaged wood surfaces or repair in a manner acceptable to Engineer prior to start of surface preparation.
 2. Solvent clean (mineral spirits) knots and other resinous areas and coat with shellac or other knot sealer, prior to painting. Remove pitch by scraping and wipe clean with mineral spirits or turpentine prior to applying knot sealer.
 3. Round sharp edges by light sanding prior to priming.
 4. Filler:
 - a. Synthetic-based wood putty approved by paint manufacturer for paint system.
 - b. For natural finishes, color of wood putty shall match color of finished wood.
 - c. Fill holes, cracks, and other surface irregularities flush with surrounding surface and sand smooth.
 - d. Apply putty before or after prime coat, depending on compatibility and putty manufacturer's recommendations.
 - e. Use cellulose type putty for stained wood surfaces.
 - f. Ensure surfaces are clean and dry prior to painting.
- H. Gypsum Board (Dry-Wall) Surface Preparation:
1. Gypsum board surfaces need no special preparation before painting. Lightly sand to remove loose paint and apply primer.
 2. Surface Finish: Dry, free of dust, dirt, powdery residue, grease, oil, or any other contaminants.
- I. Aluminum Surface Preparation
1. Clean with SSDC-SP1.
 2. Etch surface with alumiprep.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7, Brush-off Blast Cleaning.
2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.
3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.
4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
5. Engineer will approve acceptable trial blast cleaned area and will use area as a representative sample of surface preparation.
6. Repair or replace surface damaged by blast cleaning.

B. Acid Etching:

1. After precleaning, spread the following solution by brush or plastic sprinkling can: 1 part commercial muriatic acid reduced by 2 parts water by volume. Adding acid to water in these proportions gives an approximate 10 percent solution of HCl.
2. Application:
 - a. Application Rate: Approximately 2 gallons per 100 SF.
 - b. Work acid solution into surface by hard-bristled brushes or brooms until complete wetting and coverage is obtained.
 - c. Acid will react vigorously for a few minutes, during which time brushing shall be continued.
 - d. After bubbling subsides (10 minutes), hose down remaining slurry with high pressure clean water.
 - e. Rinse immediately to avoid formation on the surface of salts that are difficult to remove.
 - f. Thoroughly rinse to remove any residual acid surface condition that may impair adhesion.
3. Ensure surface is completely dry before application of coating.
4. Apply acid etching to obtain a "grit sandpaper" surface profile. If not, repeat treatment.

C. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods which involve a solvent or cleaning action.
2. Meets requirements of SSPC SP 1.

3.06 APPLICATION

A. General:

1. The intention of these Specifications is for new and existing interior and exterior wood, masonry, concrete, and metal, surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint exterior concrete or masonry surfaces, unless specifically indicated.
2. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
3. Sand wood lightly between coats to achieve required finish.
4. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
5. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
6. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
7. Water-Resistant Gypsum Board: Use only solvent type paints and coatings.
8. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.
9. Keep paint materials sealed when not in use.
10. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:

1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.
2. Prepare surface and apply primer in accordance with System No. 10 specification.
3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Shop Primed and Factory Finished Surfaces:

1. Schedule inspection with Contractor before shop priming or top coating factory finished items delivered to Site.
2. Prepare surfaces and spot prime using specified primer.
3. Apply mist coat of primer, 1-mil dry film thickness.
4. After welding, prepare and prime holdback areas as required for paint system. Apply primer in accordance with manufacturer's instructions.

D. Manufacturer Applied Paint Systems:

1. Repair abraded areas on factory finished items as recommended by manufacturer.
2. Carefully blend repaired areas into original finish.

3. Fusion Bonded Coatings: Provide appropriate liquid repair kits for field use.
- E. Porous Surfaces, such as Concrete and Masonry:
1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.
 2. Prime Coat: May be thinned to provide maximum penetration and adhesion.
 - a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.
 3. Surface Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.
- F. Damaged Coatings, Pinholes, and Holidays:
1. Feather edges and repair in accordance with recommendations of paint manufacturer.
 2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
 3. Apply finish coats, including touchup and damage-repair coats in a manner which will present a uniform texture and color-matched appearance.
- G. Film Thickness and Coverage:
1. Number of Coats:
 - a. Minimum required without regard to coating thickness.
 - b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
 2. Application Thickness:
 - a. Do not exceed coating manufacturer's recommendations.
 - b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
 3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
 - a. Perform with properly calibrated instruments.
 - b. Recoat and repair as necessary for compliance with Specification.
 - c. All coats are subject to inspection by Engineer and coating manufacturer's representative.
 4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.

5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper mileage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

H. Unsatisfactory Application:

1. If item has an improper finish color, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.
4. Leave staging and lighting up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

3.07 PROTECTIVE COATINGS SYSTEMS

A. System No. 6 Exposed Metal-Atmospheric:

Surface Prep.	Paint Material	Min. Coats, Cover
SP6, Commercial Blast Cleaning	Rust-Inhibitive Primer	1 coat, 2 MDFT
	Alkyd Enamel	2 coats, 4 MDFT

B. No. 8 Buried Metal-General

Surface Prep.	Paint Material	Min. Coats, Cover
SP10, Near-White Blast Cleaning	Standard Hot Coal-Tar Epoxy or Coal-Tar Epoxy	AWWA C203 2 coats, 16 MDFT

C. System No. 10 Galvanized Metal, Copper, and Nonferrous Metal Alloy Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Epoxy Primer-Other	As recommended by the coating manufacturer Remaining coats as required for exposure

D. No. 11 Galvanized Metal Repair:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 11) Followed by Hand Tool (SP 2), Power Tool (SP 3), or Brush-of Blast (SP 7)	Organic Zinc Rich Primer	1 coat, 3 MDFT

E. System No. 12 Skid-Resistant-Steel:

Surface Prep.	Paint Material	Min. Coats, Cover
SP10, Near-White Blast Cleaning	Epoxy Primer-Ferrous Metal	1 coat, 2.5 MDFT
	Epoxy Nonskid (Aggregated)	1 coat, 16 MDFT

F. System No. 13 Skid-Resistant-Aluminum and FRP:

Surface Prep.	Paint Material	Min. Coats, Cover
Aluminum: In accordance with Article Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation -OR- FRP: In accordance with Article Plastic and FRP Surface Preparation, this Section	Epoxy Nonskid (Aggregated)	1 coat, 16 MDFT

G. System No. 21 Skid-Resistant-Concrete:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Concrete Surface Preparation, this Section	Epoxy Nonskid (Aggregated)	1 coat, 160 SFPG

H. System No. 23 Concrete Wall:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Concrete Surface Preparation, this section.	Epoxy Filler/Surfacer	1 coat, as req'd to fill voids
	High Build Epoxy	1 coat, 160 SFPG

I. System No. 24 Exposed PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation, this Section	Acrylic Latex Flat	2 coats, 320 SFPGPC

J. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP1)	Prime in accordance appropriate paint system	
	Bituminous Paint	1 coat, 10 MDFT

K. System No. 109 Masonry Semi-Gloss:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Masonry Surface Preparation, this Section	Block Filler	1 coat, 75 SFPG
	Acrylic Latex (Semi-Gloss)	2 Coats, 240 SFPGPC

L. System No. 114 Gypsum Board and Plaster, Flat:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Gypsum Board Surface Preparation, this Section	Latex Primer Sealer	1 coat, 350 SFPG
	Acrylic Latex (Flat)	2 Coats, 240 SFPGPC

M. System No. 114 Wood, Flat:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Wood Surface Preparation, this Section	Oil Based Primer	1 coat, 300 SFPG
	Acrylic Latex (Flat)	2 Coats, 240 SFPGPC

3.08 COLORS

A. Provide as shown in this Section.

- B. Provide manufacturers color charts with paint system submittal where color is not specified. Owner will select top-coat colors during the submittal process.
- C. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.
- D. Equipment Colors:
 - 1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
 - 2. Paint equipment and piping one color as selected.
 - 3. Equipment shall have standard factory coating/painting as required in individual sections. Paint special nonsubmerged portions of equipment as itemized below:
 - a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
 - b. Fire Protection Equipment and Apparatus: OSHA Red.
 - c. Radiation Hazards: OSHA Purple.
 - d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.
- E. Pipe Identification Painting:
 - 1. Color code piping, except electrical conduit. Paint fittings and valves the same color as pipe.
 - 2. Piping Color Coding: As shown in the table in this Section.
 - 3. Do not paint stainless steel piping.
 - 4. Pipe Supports: Same color as pipe.
 - 5.

3.09 FIELD QUALITY CONTROL

- A. Testing Equipment:
 - 1. Provide magnetic type dry film thickness gauge to test coating thickness specified in mils.
 - 2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities.
 - 3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit to be as recommended by coating manufacturer.
- B. Testing:
 - 1. Thickness and Continuity Testing:
 - a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC P A 2. Check each coat

for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.

- b. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.
- c. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188.
- d. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

C. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

D. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.10 MANUFACTURER'S SERVICES

- A. In accordance with General Conditions and Division 1 coating manufacturer's representative shall be present at Site as follows:
1. On first day of application of any coating system.
 2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
 3. As required to resolve field problems attributable to or associated with manufacturer's product.
 4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.11 CLEANUP

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.
- B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

- C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.12 APPLICATION SCHEDULE

- A. As shown in the Contract Documents and as shown in the following application schedule.
- B. Surfaces Not Requiring Painting: Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:
 - 1. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, Monel, aluminum, chromium plate, atmospherically exposed weathering steel, and stainless steel, except where:
 - a. Required for electrical insulation between dissimilar metals.
 - b. Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
 - c. Color coding of equipment and piping is required.
 - 2. Nonmetallic materials such as glass, wood, and porcelain, except as required for architectural painting or color coding.
 - 3. Prefinished electrical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches (if prefinished in OSHA yellow), acoustical tile, cabinets, building louvers, and wall panels; color coding of equipment is required.
 - 4. Items specified to be galvanized after fabrication, unless specified elsewhere or subject to immersion.
- C. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting Work in question.
- D. System No. 5 Exposed Metal-Mildly Corrosive: Use on the following items or areas:
 - 1. Exposed metal surfaces, new and located inside or outside of structures and exposed to weather or in a highly humid atmosphere, such as pipe galleries and similar areas, and the following specific surfaces:
 - a. Pipe, Valves, Pumps
 - b. Jib Crane
- E. System No. 6 Exposed Metal-Atmospheric: Use on the following items or areas:
 - 1. Exposed metal surfaces, new and located inside or outside of structures or exposed to weather, including metal doors and frames, vents, louvers, exterior metal ductwork, flashing, sheet metalwork and miscellaneous architectural metal trim, and the following specific surfaces:
 - a. Electrical Cabinets

- F. System No.8 Buried Metal
 - 1. All buried metal components.
- G. System No.10 Galvanized Metal, Copper, and Nonferrous Metal Alloy Conditioning:
 - 1. In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface and the following specific surfaces:
 - a. Stairs
 - b. Handrail
 - c. Grating
 - d. Walkway platform
- H. System No. 11 Galvanized Metal Repair: Use on the following items or areas:
 - 1. Galvanized surfaces that are abraded, chipped, or otherwise damaged.
- I. System No. 12 Skid-Resistant-Steel: Use on the following items or areas:
 - 1. Steel surfaces subject to foot traffic.
- J. System No. 23 Concrete Wall: Use on the following items or areas:
 - 2. Existing and new interior concrete surfaces.
- K. System No. 13 Skid-Resistant-Aluminum and FRP: Use on the following items or areas:
 - 1. All FRP and aluminum surfaces subject to foot traffic.
- L. System No. 24 Exposed PVC: Use on the following items or areas:
 - 1. All exposed-to-view PVC or CPVC pipe (not electrical conduit).
- M. System No. 27 Aluminum and Dissimilar Metal Insulation: Use on aluminum surfaces embedded or in contact with concrete.
- N. System No. 109 Masonry Semi-Gloss: Use on the following items or areas:
 - 1. Existing and new interior masonry surfaces.
- O. System No. 114 Gypsum Board and Plaster, Flat: Use on the following items or areas:
 - 1. Existing and new interior gypsum board/drywall surfaces.
- P. System No. 120 Wood Surfaces: Use on the following items or areas:
 - 1. Existing and new interior wood surfaces.

Q. For all interior and exterior exposed pipe, paint pipe and pipe supports in accordance with Table 1 Pipe Painting System Schedule. Provide pipe labels with flow arrows in accordance with ANSI 13.1. For insulated pipe, “stripe” insulation with appropriate color every 10 linear feet of pipe length. For pipe with bands, provide 6-inch band every 2.5 linear feet of pipe for pipe OD greater 4 inches and greater and every 1.5 linear feet of pipe for pipe OD less than 4 inches.

1. Text size shall be minimum 0.5 inch high, with increasing size per increasing pipe diameters as follows:

Pipe OD (in)	Min. Text Height (in)
0.75-1.25	0.5
1.5-2.0	0.75
2.5-6.0	1.25
8-10	2.5
< 10	3.5

2. Labels shall be positioned on the pipes so they can be easily read from finished floor. Proper label placement is on the lower side of the pipe if primary visibility is from below the pipe, on the upper side of the pipe if primary visibility is from above the pipe, or directly facing if primary visibility is on the same level as the pipe. Labels shall be located near valves, branches, changes in direction, on entry/re-entry points through walls or floors, and on straight segments with spacing between labels that allows for easy identification not to exceed 10 feet.
3. Valves shall be painted using same color and color coding as pipe.
4. Pipe supports shall be painted using same color and color coding as pipe.

3.13 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. Supplement-1, Table 1: Pipe Painting System Schedule

END OF SECTION

Table 1: Pipe Painting System Schedule			
Pipe System	Pipe Label Description	Color Coding of Label	Pipe Color
Potable Water	POTABLE WATER	White on Green	OSHA Safety Blue
Pump Control Valve Drain Line	DRAIN	White on Green	Brown

SECTION 111300 – HORIZONTAL SPLIT CASE PUMPS

Equipment and Component Numbers	
<u>Tag Number</u>	<u>Equipment Name</u>
P-1	Wards Ferry Pump Station Pump No. 1
P-2	Wards Ferry Pump Station Pump No. 2

PART 1 - GENERAL

1.01 WORK OF THIS SECTION

A. The Contractor shall:

1. Furnish and install two (2) horizontal split case pumps, motors, piping, valves, appurtenances and coordinated control systems as hereinafter specified and as shown on Drawings.
2. Utilize a single Manufacturer, to ensure coordination and compatibility of equipment, for each type of equipment specified under this Section.

1.02 REFERENCES

A. Design, manufacturing and assembly of elements of the equipment herein specified shall be accordance with the standards of the below listed organizations. Where reference is made to a standard of one of the following or other organizations, the version of the standard in effect at the time of the bid opening shall apply.

1. American Gear Manufacturing Association (AGMA).
2. American Institute of Steel construction (AISC).
3. American Iron and Steel Institute (AISI).
4. American Society of Mechanical Engineers (ASME).
5. American National Standards Institute (ANSI).
6. American Society for Testing Materials (ASTM).
7. American Water Works Association (AWWA).
8. American Welding Society (AWS).
9. Anti-Friction Bearing MANUFACTURERS Association (AFBMA).
10. Hydraulic Institute Standards.
11. Institute of Electrical and Electronics Engineers (IEEE).
12. National Electrical Code (NEC).

1.03 SUBMITTALS

A. All submittals shall be in strict accordance with the requirements with the General Conditions and Division 1.

B. Shop Drawing (Pumps):

1. Pump name, identification number and specification number.

2. Pump data sheet to include nameplate data, dimensional data, materials of construction, and hydraulic characteristic curves (Pump Curve) indicating pump head, pump hydraulic and total efficiency, NPSHr, and horsepower plotted against pump flow rate at pump rotative speeds corresponding to the conditions specified. Pump curves shall indicate Allowable Operating Region and Preferred Operating Region as defined by ANSI/HI Standard 9.6.3.
 3. Motor data sheet to include nameplate data, performance data, dimensional data, wiring diagram, reed frequency analysis, and performance curves indicating rotative speed, amps, efficiency plotted against horsepower; torque and amps plotted against rotative speed; acceleration time plotted against percent full load current.
 4. General cutaway sections showing general dimensions of pump, baseplate, motor, pump center of gravity, discharge head bolt orientation, anchor bolt locations and forces, dimension of shaft projections, shaft and keyway dimensions, shaft diameter, and dimension between bearings.
 5. Uncrated total and individual weights of the pump, motor and base. Weight of all components of the pump capable of disassembly and removal for maintenance.
 6. Complete manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction for all components of pump, motor and base.
 7. Paint System Certification
- C. Shop Drawings (Valves):
1. Separate shop drawing submittals shall be made for each valve type, i.e., butterfly valves, control valves etc.
 2. Product data sheets for each make and model indicating materials of construction and relevant options.
 3. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 4. Paint System Certification
- D. Shop Drawings (Pipes):
1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, and live lengths (as applicable).
- E. Information submittals shall include the following:
1. A schedule of the date of shop testing and delivery of the equipment to the job site.
 2. Description of pump factory test procedures and equipment.
 3. Certified copies of all factory and shop test results to include certified pump curves.
- F. Manufacturer's written warranty.
- G. Manufacturers Certificates of satisfactory operation and installation are required for work under this section.

1.04 QUALITY ASSURANCE

- A. The equipment covered by these specifications shall be standard product of Manufacturers showing a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of 10 installations operating in similar service for a minimum of ten (10) years.
- B. Factory Tests: Check each pump for alignment, clearance, and vibration. Eliminate misalignments, improper clearances, and excess vibration.

1.05 DELIVERY, STORAGE & HANDLING

- A. Shipping:
 - 1. Ship equipment, material, and spare parts complete, except where partial disassembly is required by transportation regulations or for protection of components.
 - 2. Pack all spare parts in containers bearing labels clearly designating the contents.
 - 3. Deliver spare parts at the same time as pertaining equipment.
- B. Receiving:
 - 1. Contractor to inspect and inventory items immediately upon delivery to site and is responsible for storing and safeguarding equipment, material, instructions, and spare parts in accordance with manufacturer's written instructions.

1.06 WARRANTY

- A. The Manufacturer shall provide a full written warranty for all equipment under this section. The warranty period shall be 24 months from delivery of equipment or 18 months from substantial completion, whichever is shorter. If a defect is found during the warranty period, the Manufacturer shall remedy said defect at no cost to Owner.

1.07 TOOLS AND SPARE PARTS

- A. One (1) set of all special tools required for normal operation and maintenance shall be provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND MODELS

- A. Fairbanks Morse Pump

2.02 DESIGN CONDITIONS

A. Booster Pumps P-1 and P-2

Parameter	Operating Condition
Flow Conditions:	Finished Drinking Water
Design Flow and Pressure:	See Table Below
Maximum Nominal Speed (RPM):	1800
Minimum Motor Horsepower (HP):	150
Min. F.L. Nom. Motor Efficiency:	96%
Drive:	Constant Speed
Suction Port Diameter:	6-inch
Suction Port Style:	Flanged (ANSI 150)
Discharge Port Diameter:	5-inch
Discharge Port Style:	Flanged (ANSI 150)

Design Performance Conditions:					
Design Flow (gpm)	670	1,000	1,340	1,670	2,000
Design Pressure (ft)	288	281	267	245	216

- B. The Design Discharge Pressure does not include losses in the pump discharge head assembly.
- C. Pump motors shall be 460V, 3PH, 60HZ.
- D. Motors and drives shall be furnished so that they are non-overloaded throughout the entire stable operating range of the pump. The use of service factors in this determination shall not be allowed.

2.03 EQUIPMENT

A. General:

- 1. Unless otherwise stated herein, the pump shall in all respects confirm to the ANSI/AWWA-E103 for “Horizontal and Vertical Line Shaft Pumps” and shall comply with all local and state sanitary and safety regulations.

B. Materials of Construction

- 1. Pump shall be all iron construction. Casing and frame shall be cast iron per ASTM A48. Impeller shall be Bronze per ASTM B62. Shaft shall be stainless steel per ASTM A582 Type 416. Case wear ring shall be bronze per ASTM B62.

C. Casing

1. The casing shall be of the of the end suction hydraulic design, with the suction and discharge flanges the same size located on a common centerline 180 degrees apart for mounting the pipe in line. The pump shall include a volute type casing suction branch to minimize pumping noise.

D. Impeller

1. The impeller shall be vacuum cast. The impeller shall be finished all over, the exterior being turned and the interior being finished smooth and cleaned of all burrs, trimmings, and irregularities. The impellers shall be dynamically balanced. The impellers shall be key locked to the shaft.

E. Case Wearing Ring

1. The pump casing and stuffing box cover shall each be fitted with a case wear ring to minimize abrasive and corrosive wear to the casing. An additional case wear ring shall be supplied between the impellers. The case wear ring shall be of the radial type, press fitted into the casing.

F. Mechanical Seal

1. Pumps shall be furnished with a mechanical seal with a Ni-Resist seal, carbon washer, Buna-N elastomers and 303 stainless steel metal parts. The seal shall be of the split seal design. A bypass line shall be provided between the seal faces and the discharge flange to assure adequate venting of the seal chamber and to provide lubrication.

G. Shaft

1. The impeller shall be direct-coupled to the power frame shaft. The shaft shall be machined to provide an impeller keyway, and drilled and tapped to accept the impeller fastener. The shaft shall be one-piece. Stub shafts are not acceptable. The outboard shaft extension shall be machined with a keyway to accept a coupling to the driving unit. Water slingers shall be furnished on both the inboard and outboard shaft extension.

H. Shaft Sleeve

1. The pump shaft shall be fitted with a shaft sleeve to minimize shaft wear. The sleeve shall be sealed to the impeller hub by an O-ring, and shall be positively driven by a pin to the keyway. The use of adhesive compounds to fasten the sleeve to the shaft shall not be acceptable. The shaft sleeve shall be of bronze material.

I. Coupling

1. A metallic flexible coupling shall be provided to connect the pump shaft to the motor shaft. A fiberglass coupling guard shall enclose the entire rotating assembly.

J. Motor

1. The electric motor shall be premium efficient 1800 RPM, 3 phase, 60 Hz 460 volts squirrel cage induction design. Motor shall be ODP, Class F insulation with temperature rise as specified by NEMA standards for class of insulation used and shall have a 1.15 service factor.
3. The motor rating shall be such that at design conditions it will not be loaded beyond nameplate rating and at no place on the pump curve shall the loading exceed the service factor.

K. Color: OSHA Safety Blue

2.04 PIPING

- A. Pump discharge piping shall be ductile iron pipe, fittings and accessories AWWA D115/C110, Flanges Class 125 LB ANSI B 16.1 according to City of Lynchburg Manual of Specifications and Standard Details, latest edition.

B. Flexible Connectors:

1. Single Bellows type with filled arch. Materials of construction as shown or as recommended by manufacturer and approved by Engineer.
2. Provide tie rods at each flange bolt location with double nuts and area of tie bolts equal to pipe area in accordance with AWWA M11.
3. Rated working pressure 190 PSI at 170 degrees F.
4. Rated minimum movement capabilities shall be according to the following table:

Size (inch)	Axial Compression (inch)	Axial Extension (inch)	Lateral Deflection (inch)	Angular Deflection (degrees)	Torsional Rotation (degrees)
4 to 8	1.6	0.8	0.7	9.7	2
10 to 20	1.6	0.8	0.7	5	2

5. NSF Certified
6. Manufacturers and Products:
 - a. Proco Products, Inc.; Series FA 231

C. Restrained Flanged Coupling Adapters:

1. Manufacturers and Products:
 - a. EBAA Iron, Inc. Megalug Series 2100
 - b. Smith-Blair Style 912 (Restrained)

2.05 Valves

A. Butterfly Valves

1. Flanged end, short body type.
2. NSF 61 Certified
3. AWWA C504, Class 150B.
4. Cast or ductile iron body, fully rubber lined body, cast or ductile iron disc with Type 316 stainless steel shaft and Type 316 stainless steel seating surface, NBR rubber seat molded and bonded in body, and off-set disc with uninterrupted sealing surface.
5. Handwheel operator
6. Manufacturers and Products:
 - a. Dezurik BAW.
 - b. Pratt 2FII.
 - c. Golden Anderson Series 800.

B. Pump Control Valve

1. Diaphragm/Globe Body Style with ANSI 150 Class Flanges
2. NSF 61 Certified for Potable Water Service
3. Pump control valves shall regulate flow to minimize starting and stopping surges caused by pump start-up and shut-down. Pump control valves shall open slowly following initiation of pump start-up and shall close slowly following initiation of pump shutdown. A limit switch shall be interlocked with pump controls to stop pump once valve is fully closed. The valve shall be equipped with a built-in lift type check feature to prevent reverse flow, operating independently of the solenoid control.
4. The valve shall be hydraulically operated, single diaphragm actuated, dual chamber, globe pattern. The diaphragm shall consist of a rectangular resilient synthetic rubber disc. The two-piece stainless steel valve stem shall be guided by three bearings located in the cover, intermediate body, and seat.
5. Valve operation shall be controlled by an externally mounted pilot control system with a four-way solenoid operated pilot. The solenoid shall be designed to operate on either AC or DC current and have a manual operator installed. Pilot system shall include: four-way solenoid pilot valve, opening and closing speed controls, shut off valves, strainers and CVS-1 shuttle valve to provide operating pressure to the pilot system.
6. An adjustable limit switch assembly shall be mounted on the main valve, connected to the main valve stem. It shall be actuated by opening or closing of the valve. The actuating point of the limit switch shall be adjustable to any point of the valve's travel. The limit switch shall be used to complete the pump off cycle.

7. Manufacturers and Products:

- a. Cla-Val 60-11

2.06 PAINTING AND COATING

- A. Pumps and valves shall be coated according to the following Shop Coating system or an equivalent system as recommended by Manufacturer and approved by Engineer.
- B. Shop Coating:
 1. Surface preparation and painting shall be NSF Approved for Drinking Water applications as recommended by the Manufacturer and approved by the Engineer in accordance with Section 099000.
 2. Manufacturers shall submit certifications that paint systems are equal to or exceed the paint system noted above for all valves and other appurtenances.
 3. Color: OSHA Safety Blue

PART 3 – EXECUTION

3.01 GENERAL

- A. Packaged Equipment: When any system is provided as prepackaged equipment, project coordination shall include space and structural requirements, clearances, utility connections, signals, outputs, and features required by the manufacturer including safety interlocks.

3.02 INSTALLATION

- A. Contractor shall install all equipment under this Section in strict accordance with the Drawings, in strict accordance with the manufacturer's written instructions, and as specified in this Section and elsewhere in the Contract Documents.
- B. Contractor shall certify the pump's discharge port connections to process lines are nonleaking and made in a free supported state without need to apply vertical or horizontal pressure to align piping with pump nozzles.
- C. Anchor Bolts: Accurately place using equipment templates in accordance with Manufacturer's recommendations.
- D. Adjust pump assemblies such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.

- E. After pump and driver have been set in position, aligned, and adjusted to proper elevation, grout space between bottom of baseplate and concrete foundation with poured, nonshrinking grout of proper category, as specified in Section 036000, "Grout."

3.03 FIELD FINISHING

- A. In accordance with Specification 099000.

3.04 TESTING

- A. Factory Tests
 1. Perform non-witnessed performance testing in accordance with Hydraulic Institute Standards to include preparation of Certified Pump Curves.
 2. Test Report Requirements: In accordance with Hydraulic Institute Standards for the type of pumps specified under this Section.
- B. Field Tests:
 1. Contractor shall conduct running test for each pump in the presence of the Owners on-site representative to determine pumps ability to operate within the performance limits specified and to deliver its rated capacity within the pressure requirements specified.
 2. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 3. Flow Output: Measured by plant instrumentation and storage volume.
 4. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
 5. Test for continuous 3-hour period.
 6. Contractor shall provide labor, piping, equipment, and materials necessary for conducting all field tests.
 7. Test Report Requirements: In accordance with Hydraulic Institute Standards for the type of pumps specified under this Section.
- C. Test pumps on specified product/liquid only.
- D. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.
- E. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Owner are obtained.

3.05 MANUFACTURER'S REPRESENTATIVE

- A. Provide manufacturer's representative for a minimum of one (1) days total to perform installation inspection and field testing.
- B. Provide manufacturer's representative for a minimum of one-half (1/2) days total to perform operations and maintenance training.

- C. Provide a manufacturer's signed certificate of proper installation and operation for all equipment under this Section.

END OF SECTION 111300

SECTION 131000 - PROTECTED ABOVE GROUND STORAGE TANK

Equipment Description
Diesel Fuel Storage Tank for Emergency Generator

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The Contractor shall:

1. Furnish and install one (1) protected above ground storage tank and appurtenances as specified and shown on the Drawings for the storage of diesel fuel for the emergency generator.

- B. The protected above ground storage tank specified in this Section shall be provided by a single manufacturer to ensure coordination and compatibility of equipment.

1.2 REFERENCES

A. The tank shall be tested to a listed for the following:

1. UL-142.
2. UL-2085.
 - a. Two-hour furnace fire test and two hour simulated pool fire test for insulated and protected tanks.
 - b. Protected aboveground tanks for flammable and combustible liquids.
 - c. Non-Metallic Secondary Containment protected tanks for flammable and combustible liquids with secondary containment Emergency Venting by "Form of Construction".
3. UL-2085 and UFC Test Standard (Article 79 or Appendix #A-II-F-1):
 - a. Both Vehicle Impact Protection and Projectile Resistance.
4. CAN/ULC-S601 (ORD-142.18).
5. CAN/ULC-S655 (ORD – C 142.16).
6. CAN/ULC-(ORD – C 142.5).
7. CAN/ULC-(ORD – C 142.16).
8. CAN/ULC-(ORD – C 142.25).
9. CAN/ULC-(ORD – 142.23).
10. Uniform Fire Code (UFC) 2-hour firewall test.
11. California Air Resources Board (CARB) for Balanced Phase 1 and Phase II Vapor Recovery, including methanol and ethanol.

1.3 DEFINITIONS

- A. Diesel Fuel: Class II Combustible Liquid per NFPA 30.

1.4 SYSTEM DESCRIPTION

A. Design Criteria:

1. The vaulted system shall have in its design and construction both primary (U.L.) steel tank and the secondary containment internal to the concrete re-bar reinforced monolithic concrete vault.
2. The tank shall be approved for listing under U.L. Standard 2085, Aboveground Tanks, Protected Type, Secondary Containment with Vehicle Impact and Projectile Resistance. Unit must comply with all provisions of U.F.C. 79-7, Appendix A-II-F. The tank and its enclosure shall be a completed unit at the factory. The tank system shall be approved for Phase I and Phase II Vapor Recovery by the California Air Resources Board for gasoline and methanol.

B. Performance Requirements:

1. Tank shall have one compartment with a total storage volume of 500 gallons.
2. Each tank compartment shall have a refilling station on the tank/compartment exterior. Refilling station shall be configured and designed according to all applicable codes and regulations.

1.5 SUBMITTALS

- A. All submittals shall be in accordance with Division 1 requirements and General Conditions.

B. Shop Drawings:

1. Fabricator's catalog information, descriptive literature, specifications, and identification of materials of construction. Provide catalog cuts for all off-the-shelf items.
2. Detailed fabrication drawings shall be scale drawings showing the relative size, configuration, location, materials of construction, and details of all equipment and materials to be furnished including the tanks, fittings, access ladders, supports, and tank holddown and support systems. Both plan and elevation views shall be provided. All piping terminal points shall be clearly shown and fully dimensioned.
 - a. Foundation and Anchor Bolt Drawings: Drawings shall be provided that show all data and details required for design of the tank foundations including locations and dimensions for knockouts and embedded items, and the size, type, location, embedment and projection of anchor bolts.
 - b. Complete design calculations for tanks, supports and appropriate accessories. Diagrams and calculations shall be provided that indicate all static and dynamic loads. Reactions (uplift, shear, gravity loads, etc.) shall be indicated for each of the applicable loading combinations found in the

- Virginia Uniform Building Code. Calculations for anchor bolt type, size, and location.
- c. Tank data indicating pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, and details of nozzle designs.
 - d. Tank capacity chart indicating gallons for each inch of depth and cumulative total from bottom.
 - e. Certified test data on representative samples of standard materials which demonstrate compliance with the physical properties specified herein.
 - f. Certified copy of all factory test results. Provide a listing of procedures used in testing.
 - g. Installation Instructions: Installation instructions shall be completed, detailed, and sequenced instructions for original installation. Recommended methods for assembly and adjustment including all bolt torques shall be provided along with special precautions and the sequence of work. Rigging and lifting details shall also be included for all factory-fabricated assemblies and individual components weighing over 100 pounds.
- C. Provide certification that the tank's materials of construction are compatible with the product being stored.
- D. Manufacturer shall supply a detailed listing of all applicable codes and regulations pertaining to protected above ground storage tanks used for storage of a Class 1B flammable liquid as specified and indicated in the contract documents and shall provide corresponding certifications that the tank and all appurtenances specified under this Section meet or exceed the requirements of aforementioned codes and regulations.
- E. The manufacturer shall provide a certificate of satisfactory installation under this Section.
- F. Manufacturer's written warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer shall have a minimum of 10 year's experience in producing specified tank for commercial use and document at least 100 installations in satisfactory operation.

1.7 DELIVERY, STORAGE & HANDLING

- A. Ship equipment, material, and spare parts complete, except where partial disassembly is required by transportation regulations or for protection of components.
- B. Pack all spare parts in containers bearing labels clearly designating the contents.
- C. Deliver spare parts at the same time as pertaining equipment.
- D. Contractor to inspect and inventory items immediately upon delivery to site and is responsible for storing and safeguarding equipment, material, instructions, and spare parts in accordance with manufacturer's written instructions.

1.8 WARRANTY

- A. The tank shall be warranted for a minimum of 20 years by the manufacturer. Said warranty shall be applicable to the primary tank, secondary containment system, spill overflow containment system and concrete encasement.
- B. The Manufacturer shall provide a full written warranty for all other equipment under this Section. The warranty period shall be 24 months from delivery of equipment or 18 months from substantial completion, whichever is shorter. If a defect is found during the warranty period, the Manufacturer shall remedy said defect at no cost to Owner.

1.9 SPARE PARTS

- A. None.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. ConVault Above ground Tank System.

2.2 EQUIPMENT

- A. Primary Tank:

- 1. The primary tank shall be rectangular in shape, constructed with a minimum of 10 gauge thick carbon steel, listed per U.L. Standard 142, and meet the requirements of N.F.P.A. 30. Welds shall be continuous on all sides, conforming with the American Welding Society Standard for continuous weld.

- B. Concrete Encasement:

- 1. The concrete encasement shall be 6-inches thick with a minimum design strength of 4000 psi. Concrete enclosure shall encase and protect both the primary steel tank and the secondary containment. The concrete design shall include the following for long term durability: less than 3 percent air entrainment, water-reducing admixture, and steel reinforcing bars. Concrete placement shall be monolithic (without seams) and placement methods shall ensure the absence of voids on all sides and beneath the steel tank. An exterior steel jacket covering the concrete vault will Not be permitted. The steel tank shall be prestressed at factory by pressurizing the primary steel tank to 5 psi during concrete encasement to allow for expansion and contraction of the primary steel tank. Vault enclosure shall have concrete support legs of unitized monolithic construction raising the concrete enclosure a minimum of 3-inch above the ground to meet visual inspection requirements. A mid-level seam or other joint construction which could compromise the liquid tightness (secondary containment) and fire protection capability of the vault is not permitted.

C. Fire Resistance:

1. The tank system shall be designed and tested to provide 2-hour fire protection for the primary tank as per U.L. 2085 2-hour furnace fire test and 2-hour simulated pool fire test. No steel members shall penetrate the walls or floor of the concrete encasement to assure isolation from pool fire heat.

D. Thermal and Corrosion Protection:

1. The tank construction shall include thermal insulation equivalent to 0.25 inches of polystyrene to protect against temperature extremes, and to protect against corrosion by isolating the steel tank from the concrete or other corrosive material. All steel exterior to the concrete encasement shall be anti-oxidant powder coated to inhibit corrosion and meet A.S.T.M. B117.

E. Secondary Containment with Leak Monitoring:

1. The tank system shall include an impervious barrier of 30 mil high density polyethylene to contain leaks from the primary tank. A monitoring tube shall be located between the inner tank and secondary barrier.

F. Spill/Overfill Containment:

1. The tank system shall include a U.L. listed 7 gallon spill/overfill container manufactured as an integral part of the primary tank, surrounding the fill pipe, and protected by the 2 hour fire rating of the enclosure. The spill/overfill container shall include a stick port and normally closed valve to release spilled product into the main tank. Exterior steel shall be anti-oxidant powder coated to inhibit rust.

G. Overfill Protection:

1. Overfill protection shall be provided by the following methods: a) direct reading level gauge visible from fill pipe access; and b) valve rated for pressurized delivery located within fill pipe to close automatically at 95 percent full level.

H. Anti-Spill Valves

1. Where product piping extends below the top of the tank, the piping shall include a shutoff valve and normally closed safety valve. The safety valve shall be an approved electric solenoid valve.

I. Base Slab:

1. Tanks shall be installed on a reinforced concrete base slab designed to support the fully loaded tank. Protective bollards shall be installed where required by state and local codes.

J. Exterior Finish:

1. The tank system shall be a low maintenance, exposed aggregate exterior concrete finish. Painted concrete, fiber clad steel, or painted steel vault tanks are not acceptable.

K. Signage:

1. Tanks shall be marked on all sides as per state and local codes. Signs will be recessed in concrete exterior to insure against damage during off-loading, refilling or general functions.
2. A UL 2085 label must be permanently affixed to the tank: other third-party testing labels are not acceptable.
3. Tanks shall be marked on all sides with warning signs: "Flammable" or "Combustible", "No Smoking", product identification, and other signs as required by applicable codes.

L. Venting:

1. Tank system shall include a 2-inch atmospheric vent and emergency venting in accordance with N.F.P.A. 30.

M. Electrical:

1. Electrical Work shall be in accordance with applicable codes and shall be rated for hazardous area as indicated in the Contract Documents. Electric feed for dispensing pumps shall include an emergency shutoff switch located per code requirements. Tanks shall be electrically grounded in accordance with N.F.P.A. 780.

N. Electronic Monitoring and Gauging System:

1. Provide a Class I, Division I Group D rated panel at storage tank to locally display tank level and high level alarm (visual and audible).

O. Additional Tank Design Criteria:

1. Seismic Load: Category C, Exposure Group III.
2. Live Load: 250 pounds per square foot.
3. Concentrated Load: 300 pounds.
4. Wind Loads: 125 mph.
5. Special Loads: Design tanks for dead loads from all attached piping.
6. Hydrostatic Load: For specific gravities of stored materials specified herein. Tanks shall be designed to withstand the hydrostatic pressure resulting from the worst case condition of any combination of tank compartments being full or empty.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The tank system, including accessories, shall be installed in strict accordance with the manufacturer's recommendations and applicable fire and environmental codes. All state and local permits shall be obtained by Contractor prior to installation.

3.2 TESTING & MANUFACTURERS SERVICES

- A. Provide manufacturer's representative for a minimum of one (1) day to perform installation inspection and field testing.
- B. Provide manufacturer's representative for a minimum of one (1) day to perform operations and maintenance training.
- C. Provide a manufacturer's signed Certificates of Proper Installation and Operation for all equipment under this Section.

END OF SECTION

SECTION 137381 - ELECTRONIC FLOW INSTRUMENTATION, DIFFERENTIAL PRESSURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES

- A. American National Standards Institute (ANSI), International Organization for Standardization (ISO) Publication
 - 1. ISO/R541 Measurement of Fluid Flow by Orifice Plates and Nozzles
- B. American Society of Mechanical Engineers (ASME) Publication
 - 1. Fluid Meters, 6th Edition
- C. Instrument Society of America (ISA) Publications
 - 1. S5.1 Instrumentation Symbols and Identification
 - 2. S5.4 Instrument Loop Diagrams
 - 3. RP12.1 Recommended Practice for Electrical Instruments in Hazardous Atmospheres
 - 4. S51.1 Standard Process Instrumentation Terminology
- D. National Electrical Manufacturers Association (NEMA) Publications
 - 1. ICS 1 General Standards for Industrial Controls and Systems
 - 2. ICS 2 Standards for Industrial Control Devices, Controllers, and Assemblies
 - 3. ICS 6 Enclosures for Industrial Controls and Systems

1.3 INSTRUMENTATION LOOP

- A. Instrumentation loop shall be 4 20 mA. Loop loads shall be within the current source load capacity.

1.4 ENCLOSURES

- A. Enclosures shall be as follows:
 - 1. Nonhazardous Areas: Cast, NEMA 4X corrosion resistant.

1.5 SUBMITTALS

- A. Provide submittals in a timely manner in accordance with the approved submittals schedule as specified in Division 1 – General Requirements.
 - 1. Differential Pressure Flowmeter

PART 2 - PRODUCTS

2.1 DIFFERENTIAL PRESSURE FLOW INSTRUMENTS

- A. General: The metering primary element shall be of the pressure differential producing type and sense true static pressure at the inlet and at the throat or cone. Flowmeters that measure the flow rate using any method besides measuring the static pressure change shall not be accepted. Also, flowmeters that use devices that amplify differential through change in direction of the flow at the cross-sections where inlet and/or throat static pressure is sensed shall not be accepted.
 - 1. Provide a complete system including a close coupled 3-way valve isolation manifold connected by close nipples attached to the primary flow element to isolate the sensing line from the differential pressure transmitter. The isolation manifold shall be a 316 Stainless Steel Block Type. In addition, the system shall include three valve manifold equalizer lines, two block valves, two condensate legs, and two vent and drain valves.
 - 2. The flow meter shall consist of a conical type element as positioned in the center of the flow tube to reshape the upstream fluid velocity profile, reducing upstream/downstream piping requirements, allowing greater turndown (rangeability), and creating a region of low pressure downstream of the cone.
 - 3. Primary elements with rotating and/or moving parts, and/or sudden constrictions, are not acceptable.
 - 4. The pressure difference between the static line pressure upstream of the cone and the low pressure area created after the cone shall be measured via two (2) pressure taps that will resist plugging. Low pressure shall be sensed through the cone in the center of the line. The pressure taps shall be positioned upstream of the cone element, and spaced an appropriate distance apart to properly ensure orderly connection with the 3-way valve isolation manifold via pressure sensing tubing.
 - 5. The flow tube shall be rotated around the x-axis during installation so that the pressure sensing ports will resist air entrapment and sediment build-up. At zero flow conditions the static pressure of the high and low pressure ports shall be equal.
 - 6. The primary flow element shall be designed to re-profile and flatten the fluid velocity profile from any turbulent flows, minimize permanent head loss, reduce upstream and downstream straight meter run requirements, and minimize wear of the conical element.

- B. Tube Design: The inlet section that incorporates the high-pressure tap shall be a cylindrical section of the same diameter as the pipe. The low-pressure tap shall be installed in a throat section that shall be cylindrical for a minimum length of 1/2 of the throat diameter, or through a cone that is suspended in a cylindrical section the same diameter as the inlet section. If incorporating a throat section to develop the low-pressure signal, the outlet section shall have an included angle of 10 degrees or less. If incorporating a cone to develop the low-pressure signal, the outlet section shall be the same diameter as both the inlet and throat sections.
1. The body and cone shall be 304 stainless steel per ASTM A 240, Schedule 40 pipe, and ANSI B16.5 weld neck, Class 300 raised face flanged end connections.
- C. Meter Performance: The accuracy of the flowmeter, installed per the manufacturer's recommendations, shall be +/-0.50% of actual flow and repeatability shall be +/-0.1% for all calibrated units over a range of 10:1. Detailed data on the effects of upstream piping must be submitted and must be the result of tests performed on the meter design proposed by and fabricated by the manufacturer. Data taken from ASME or other organizations will not be considered responsive to this requirement and will be rejected.
- D. Manufacturer:
1. BIF

2.2 FLOW TRANSMITTERS

- A. Flow transmitters for service across differential pressure flow elements shall be differential pressure transmitters with on board square root extraction as specified in Section 137420_02 "Electronic Pressure Instrumentation". Differential pressure transmitters used for flow shall be characterized for optimized flow.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flow elements with upstream and downstream straight, unobstructed runs in accordance with manufacturer's recommendations. Where there is insufficient straight run, install straightening vanes.
- B. Install in accordance with manufacturer's written instructions.

3.2 FLOW COEFFICIENT

- A. The data that determines the flow coefficient shall be generated from equations derived from Bernoulli's Equation. The flow coefficient may be calculated by the factory authorized sizing programs (both paper and computer versions) for the primary element. The data used to calculate the coefficient shall take into consideration the effect of up and downstream piping configurations, the head loss associated with the aforementioned, and the beta ratio of the

conical element within the pipe. The calculations shall provide data indicating the independence of the coefficient from the flow rate within the specified rangeability of the primary element. The meter's flow coefficient shall not vary more than +/-0.5 percent throughout the entire specified turndown range.

END OF SECTION 137381

SECTION 137420.02 - ELECTRONIC PRESSURE INSTRUMENTATION
(LIQUID, STEAM, GASES)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES

- A. Instrument Society of America (ISA) Publications
 - 1. S5.1 Instrumentation Symbols and Identification
 - 2. S5.4 Instrument Loop Diagrams
 - 3. RP12.1 Recommended Practice for Electrical Instruments in Hazardous Atmospheres
 - 4. RP12.6 Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations
 - 5. S51.1 Standard Process Instrumentation Terminology
- B. National Electrical Manufacturers Association (NEMA) Publications
 - 1. ICS 1 General Standards for Industrial Controls and Systems
 - 2. ICS 2 Standards for Industrial Control Devices, Controllers, and Assemblies
 - 3. ICS 6 Enclosures for Industrial Controls and Systems

1.3 PRESSURE INSTRUMENTATION LOOP

- A. Pressure instrumentation loop shall be 4 20 mA. Loop loads shall be within the current source load capacity.

1.4 ENCLOSURES

- A. Enclosures shall be as follows:
 - 1. Nonhazardous Areas: Cast, NEMA 4X, corrosion resistant

1.5 SUBMITTALS

- A. Provide submittals in a timely manner in accordance with the approved submittals schedule as specified in Division 1 – General Requirements.
 - 1. Pressure Transmitter Data

2. Hart Interface Unit Data
3. Instrument and Gauge Valve Data
4. Differential Pressure Instrument Valve Manifold Details

PART 2 - PRODUCTS

2.1 PRESSURE TRANSMITTERS

A. Pressure transmitters shall have the following features:

1. Differential pressure transmitters shall be microprocessor based digital devices
 - a. Accuracy: Plus or minus 0.1 percent of span at a turndown of up to 10 to 1 (includes linearity, hysteresis, and repeatability).
 - b. Ambient Temperature Range: Minus 20 to 180 degrees F.
 - c. Line Voltage Effect: Maximum output change of less than 0.005 percent of span per volt dc.
 - d. Stability: 0.2 percent of upper range limit per 12 months.
 - e. Elevated Zero and Suppressed Zero: Only limitation is the maximum span and the upper and lower range limits cannot be exceeded.
 - f. Working Pressure: 200 percent of system pressure rating, minimum.
 - g. Overrange Pressure: 1,000 percent of system pressure rating.
 - h. Turndown: 10 to 1 minimum.
 - i. Temperature Effect: Maximum change of plus or minus 1 percent of span per 100 degree f temperature change.
 - j. All adjustments including zero and span shall be internal to the enclosure.
 - k. Signal Output: A hart based protocol digital signal and a 4-20 mA analog signal shall be output. It shall be possible to calibrate the transmitter using a handheld universal hart interface unit either locally or remotely. Additionally it shall be possible to calibrate the transmitter using 4-20 mA analog calibration techniques.
 - l. Output signal indicator shall be a four-digit liquid crystal display.
 - m. Wetted Parts: 316 stainless steel or ceramic.
 - n. Sensor Fill Fluid: silicone oil where applicable.
 - o. Electronics Housing: NEMA 4X low copper cast aluminum with epoxy coating.
 - p. Differential pressure flow transmitters (head instruments such as orifice plates and venturi tubes) shall be provided with on board square root extraction unless it is provided by other devices in the loop. Differential pressure transmitters used for flow shall be characterized for optimized flow.
 - q. Manufacturer and Type:
 - 1) The Foxboro Company

2. Gauge pressure transmitters shall be microprocessor based digital devices:
 - a. Accuracy: Plus or minus 0.1 percent of span at a turndown of up to 10 to 1 (includes linearity, hysteresis, and repeatability).
 - b. Ambient Temperature Range: Minus 20 to 180 degrees F.
 - c. Line Voltage Effect: Maximum output change of less than 0.005 percent of span per volt dc.
 - d. Stability: 0.2 percent of upper range limit per 12 months.
 - e. Elevated Zero and Suppressed Zero: Only limitation is the maximum span and the upper and lower range limits cannot be exceeded.
 - f. Working Pressure: 200 percent of system pressure rating, minimum.
 - g. Overrange Pressure: 1,000 percent of system pressure rating.
 - h. Turndown: 10 to 1.
 - i. Minimum Temperature Effect: Maximum change of plus or minus 1 percent of span per 100 degree f temperature change.
 - j. All adjustments including zero and span shall be internal to the enclosure.
 - k. Signal output: a hart based protocol digital signal and a 4-20 mA analog signal shall be output. It shall be possible to calibrate the transmitter using a handheld universal hart ambient interface unit either locally or remotely. Additionally it shall be possible to calibrate the transmitter using 4-20 mA analog calibration techniques.
 - l. Output signal indicator shall be a four-digit liquid crystal display.
 - m. Wetted Parts: 316 stainless steel or ceramic.
 - n. Sensor Fill Fluid: Silicone oil where applicable.
 - o. Electronics Housing: NEMA 4X low copper cast aluminum with epoxy coating
 - p. Manufacturer and Type
 - 1) The Foxboro Company
3. Universal Hand Held Hart Interface Unit: A hart interface unit shall be supplied which is compatible with the supplied transmitters and with any other hart protocol compatible unit. The unit shall be capable of calibrating and configuring all hart protocol transmitters.

2.2 INSTRUMENT AND GAUGE VALVES

- A. Instrument and gauge valves shall have the features listed below:

1. Bar stock, ball type.
2. Body: 316 stainless steel.
3. Ball: 316 stainless steel.
4. Spring: 316 stainless steel.
5. Washers: Teflon.
6. Seats: Teflon.
7. Output ports: Two minimum.
8. Manufacturer and Type: Hoke, Inc., Roto Ball; Anderson, Greenwood & Co M5; or Whitey Co., 40 Series (Div. of Swagelock).

2.3 DIFFERENTIAL PRESSURE INSTRUMENT VALVE MANIFOLDS

- A. Differential pressure instrument valve manifolds shall have the following features:
 - 1. 316 or 416 stainless steel.
 - 2. Three way or five way valving as required to provide shutoff, equalization, and venting.
 - 3. Manufacturer and Type: Hoke, Inc.; Whitey Company Division of Swagelock; or Anderson, Greenwood & Company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install instrument and gauge valves on all pressure transmitter sensing legs so that transmitter can be removed for servicing without shutting down or draining the system.
- B. Install an instrument valve manifold on each differential pressure transmitter.
- C. All pressure transmitters shall have the range selected so the operating span does not require an excessive turndown which would affect the accuracy of the transmitter.
- D. The provided pressure transmitters, valves, and manifolds shall be suitable for the specific application including process fluid and ambient conditions.

END OF SECTION 137420.02

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alcan Products Corporation; Alcan Cable Division.
 2. Alpha Wire.
 3. Belden Inc.
 4. Encore Wire Corporation.
 5. General Cable Technologies Corporation.
 6. Southwire Incorporated.

- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Gardner Bender.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. IlSCO; a branch of Bardes Corporation.
 - 6. NSi Industries LLC.
 - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 8. 3M; Electrical Markets Division.
 - 9. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. VFC Output Circuits: Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Equipment Controlled by Solid State Motor Controllers.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - a. Detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Low-voltage control cabling.
 - 2. Control-circuit conductors.
 - 3. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with UL 1685.

2.3 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Encore Wire Corporation.
 - 2. General Cable Technologies Corporation.
 - 3. Southwire Company.
- B. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- C. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.

2.4 SOURCE QUALITY CONTROL

- A. Cable will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test cables on receipt at Project site.

3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
 2. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
1. Comply with TIA-568-C Series of standards.
 2. Cables may not be spliced.
 3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 6. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
 7. Support: Do not allow cables to lay on removable ceiling tiles.
 8. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
- C. Installation of Control-Circuit Conductors:
1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.5 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
1. Class 1 remote-control and signal circuits; No 14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.6 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 2. Test UTP cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Retain "Optical-Fiber Cable Tests" Subparagraph below if verification of quality is to be performed before Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
 - 1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad, 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Receptacle circuits.
 - 3. Three-phase motor and appliance branch circuits.
- C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.6 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Handhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
- B. Related Sections include the following:

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.

5. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 6. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 7. Rated Strength: Selected to suit applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts with.
 6. To Light Steel: Sheet metal screws.
 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Surface raceways.
 - 5. Boxes, enclosures, and cabinets.
 - 6. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.

5. O-Z/Gedney.
 6. Picoma Industries.
 7. Republic Conduit.
 8. Robroy Industries.
 9. Southwire Company.
 10. Thomas & Betts Corporation.
 11. Western Tube and Conduit Corporation.
 12. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions were installed, and including flexible external bonding jumper.
- H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. Arcco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corporation.
 6. Condux International, Inc.
 7. Electri-Flex Company.
 8. Kraloy.
 9. Lamson & Sessions; Carlon Electrical Products.

10. Niedax-Kleinhuis USA, Inc.
11. RACO; Hubbell.
12. Thomas & Betts Corporation.

- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper B-Line, Inc.
 2. Hoffman.
 3. Mono-Systems, Inc.
 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 4 unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.
- F. Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 Insert requirements for finish-coat paint color, if applicable, in "Surface Metal Raceways" Paragraph BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman.
7. Hubbell Incorporated.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney.
12. RACO; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are allowed.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. NewBasis.
 - d. Oldcastle Precast, Inc.
 - e. Quazite: Hubbell Power System, Inc.
 - f. Synertech Moulded Products.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRIC."
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. NewBasis.
 - d. Nordic Fiberglass, Inc.
 - e. Oldcastle Precast, Inc; Christy Concrete Products.
 - f. Quazite: Hubbell Power System, Inc; Hubbell Power Systems.
 - g. Synertech Moulded Products.
 2. Standard: Comply with SCTE 77.
 3. Color of Frame and Cover: Gray.
 4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 7. Cover Legend: Molded lettering, "ELECTRIC."
 8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC Underground Conduit: RNC, Type EPC-40-PVC, direct buried and concrete encased when indicated on the drawings..
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Equipment Rooms.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install nonmetallic conduit where ambient temperature exceeds 120 degrees F

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

- O. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where an underground service raceway enters a building or structure.
 2. Where otherwise required by NFPA 70.
- P. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Q. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 degrees F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 degrees F and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 degrees F.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degrees F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degrees F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- T. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

- U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- V. Locate boxes so that cover or plate will not span different building finishes.
- W. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Y. Set metal floor boxes level and flush with finished floor surface.
- Z. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line. The frost line is below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
 - C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint in."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils.
3. Weight: 18.5 lb/1000 SF.
4. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 degrees F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 degrees F.
 - 4. Color: Black except where used for color-coding.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

- a. Colors for 208/120-Volt Circuits:

- 1) Phase A: Black.
- 2) Phase B: Red.
- 3) Phase C: Blue.

- b. Colors for 480/277 – Volt Circuits:

- 1) Phase A: Brown
- 2) Phase B: Orange
- 3) Phase C: Yellow

- c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive, self-laminating polyester labels with the conductor designation.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be [, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Emergency system boxes and enclosures.
 - e. Enclosed switches.
 - f. Enclosed circuit breakers.
 - g. Enclosed controllers.
 - h. Variable-speed controllers.
 - i. Push-button stations.
 - j. Power transfer equipment.
 - k. Battery racks.
 - l. Power-generating units.

END OF SECTION 260553

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.

1.3 ACTION SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Source quality-control test reports.
- B. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

- A. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ACME Electric Corporation; Power Distribution Products Division.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 3. General Electric Company.
 - 4. Magnetek Power Electronics Group.
 - 5. Siemens Energy & Automation, Inc.
 - 6. Sola/Hevi-Duty.
 - 7. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Aluminum

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Ventilated NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
 - 2. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: Gray.
- E. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- G. Wall Brackets: Manufacturer's standard brackets.
- H. Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:
 - 1. 30 to 50 kVA: 45 dBA.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- B. Panelboard Schedules: For installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 018300 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 degrees F to plus 104 degrees F.
 - b. Altitude: Not exceeding 6600 feet.

- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than Seven days in advance of proposed interruption of electric service.
 2. Do not proceed with interruption of electric service without Owner's written permission.
 3. Comply with NFPA 70E.

1.10 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface mounted cabinets.
1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 4.
 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

3. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top.
- C. Phase, Neutral, and Ground Buses:
1. Material: Tin-plated aluminum.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material] Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker.

- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. For first subparagraph below, 120-V units trip at 55 percent or more of rated voltage; all other voltages trip at 75.
 - e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- G. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Communications outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), CR5362 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).

- c. Leviton; 5891 (single), 5352 (duplex).
- d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Pass & Seymour; 2095.
 - d. Leviton; 7590.

2.5 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; CWL520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Single Pole:
 - b. Cooper; AH1221.
 - c. Hubbell; HBL1221.
 - d. Leviton; 1221-2.

2.7 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.
 - 1. Comply with UL 514 scrub water exclusion requirements.

2.8 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- B. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Cartridge fuses rated 600-V ac and less for use in control circuits enclosed switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 3. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 018300 "Operation and Maintenance Data," include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

1.7 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 degrees F or more than 100 degrees F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Bussmann, Inc.
 2. Edison Fuse, Inc.
 3. Ferraz Shawmut, Inc.
 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Service Entrance: Class RK1, time delay.
 - 2. Motor Branch Circuits: Class RK1 time delay.
 - 3. Other Branch Circuits: Class RK1, time delay.
 - 4. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
 - 1. Test results that comply with requirements.
 - 2. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 018300 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 degrees F and not exceeding 104 degrees F.
 - 2. Altitude: Not exceeding 6600 feet.

- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
 2. Indicate method of providing temporary electric service.
 3. Do not proceed with interruption of electric service without Owner's written permission.
 4. Comply with NFPA 70E.

1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
 6. Service-Rated Switches: Labeled for use as service equipment.
 7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 3. Hookstick Handle: Allows use of a hookstick to operate the handle.
 4. Lugs: Mechanical type, suitable for number, size, and conductor material.
 5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
 5. Show pole quantities and voltage and ampere ratings of MCCBs and switches on Drawings. See Editing Instruction No. 6 in the Evaluations.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- E. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Outdoor Locations: NEMA 250, TYPE 4X.
 2. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
 - 2. Full-voltage magnetic.
 - 3. Reduced-voltage solid state.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.

- c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
 - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
 2. Wiring Diagrams: For power, signal, and control wiring.
- 1.5 INFORMATIONAL SUBMITTALS
 - A. Field quality-control reports.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Routine maintenance requirements for enclosed controllers and installed components.
 2. Manufacturer's written instructions for setting field-adjustable overload relays.
 3. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
- 1.7 MATERIALS MAINTENANCE SUBMITTALS
 - A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 2. Indicating Lights: Two of each type and color installed.
 3. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
 4. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.
- 1.8 QUALITY ASSURANCE
 - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).
- B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than Seven days in advance of proposed interruption of electrical systems.
 - 2. Indicate method of providing temporary utilities.
 - 3. Do not proceed with interruption of electrical systems without Owner's written permission.
 - 4. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - 1. Surface mounting.
- B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

- b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
2. Configuration: Nonreversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 4. Surface mounting.
 5. Red pilot light.
- C. Magnetic Controllers: Full voltage, across the line, electrically held.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
 2. Configuration: Nonreversing.
 3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 5. Control Circuits: 120 V ac; obtained from integral CPT, with primary and secondary fuses, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 50 VA.
 6. Bimetallic Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 10 tripping characteristic.
 - c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - d. Ambient compensated.
 - e. Automatic resetting.
 7. N.O, isolated overload alarm contact.
 8. External overload reset push button.

2.2 REDUCED-VOLTAGE SOLID-STATE CONTROLLERS

- A. General Requirements for Reduced-Voltage Solid-State Controllers: Comply with UL 508.
- B. Reduced-Voltage Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - c. Rockwell Automation, Inc.; Allen-Bradley brand.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D; a brand of Schneider Electric.
 2. Configuration: Standard duty nonreversible.
 3. Starting Mode: Voltage ramping, Current limit Torque control; field selectable
 4. Stopping Mode: Coast to stop braking; field selectable.
 5. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
 6. Shorting and Input Isolation Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating.
 7. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
 8. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 100 VA.
 9. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
 10. SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration with external feedback from the motor or driven equipment.
 11. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
 - a. Adjusting motor full-load amperes, as a percentage of the controller's rating.
 - b. Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
 - c. Adjusting linear acceleration and deceleration ramps, in seconds.
 - d. Initial torque, as a percentage of the nominal motor torque.

- e. Adjusting torque limit, as a percentage of the nominal motor torque.
 - f. Adjusting maximum start time, in seconds.
 - g. Adjusting voltage boost, as a percentage of the nominal supply voltage.
 - h. Selecting stopping mode, and adjusting parameters.
 - i. Selecting motor thermal overload protection class between 5 and 30.
 - j. Activating and de-activating protection modes.
 - k. Selecting or activating communication modes.
12. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
- a. Controller Condition: Ready, starting, running, stopping.
 - b. Motor Condition: Amperes, voltage, power factor, power, and thermal state.
 - c. Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
13. Controller Diagnostics and Protection:
- a. Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
 - b. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
 - c. Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component or when the motor is stopped.
14. Remote Output Features:
- a. All outputs prewired to terminal blocks.
 - b. Form C status contacts that change state when controller is running.
 - c. Form C alarm contacts that change state when a fault condition occurs.
15. Optional Features:
- a. Analog output for field-selectable assignment of motor operating characteristics; 0 to 10-V dc or 4 to 20-mA dc.
 - b. Additional field-assignable Form C contacts, as indicated, for alarm outputs.
 - c. Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - d. Full-voltage bypass contactor operating manually, with Normal/Bypass selector switch. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.
 - e. Solid-State Overload Relay:
 - 1) Switch or dial selectable for motor running overload protection.

- 2) Sensors in each phase.
 - 3) Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.
- f. N.O., isolated overload alarm contact.
 - g. External overload reset push button.

2.3 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 1. Other Wet or Damp Indoor Locations: Type 4X

2.4 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy duty, oiltight type.
 - a. Push Buttons: Recessed types; momentary as indicated.
 - b. Pilot Lights: LED Transformer types; colors as indicated; push to test.
 - c. Selector Switches: Rotary type.
 2. Elapsed Time Meters: Heavy duty with digital readout in hours; resettable.
 3. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.
- B. Reversible N.C./N.O. auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- E. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- F. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
- G. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."
- D. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- F. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed controllers will be considered defective if they do not pass tests and inspections.

- F. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer and Owner before increasing settings.
- D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

3.7 PROTECTION

- A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage solid-state controllers.

END OF SECTION 262913

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged engine-generator sets for standby power supply with the following features:
 - 1. Diesel engine.
 - 2. Unit-mounted cooling system.
 - 3. Unit-mounted control and monitoring.
 - 4. Performance requirements for sensitive loads.
 - 5. Load banks.
 - 6. Outdoor enclosure.
- B. Related Sections include the following:
 - 1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
4. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Qualification Data: For manufacturer.
- C. Source quality-control test reports.
1. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
 2. Report of sound generation.
 3. Report of exhaust emissions showing compliance with applicable regulations.
 4. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- D. Field quality-control test reports.
- E. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with ASME B15.1.
- F. Comply with NFPA 37.
- G. Comply with NFPA 70.
- H. Comply with NFPA 110 requirements for Level 2 emergency power supply system.
- I. Comply with UL 2200.
- J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than Seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Altitude: Sea level to 1000 feet (300 m).

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide engine-generator set by one of the following:

1. Caterpillar; Engine Div.
2. Kohler Co.; Generator Division.
3. Onan/Cummins Power Generation; Industrial Business Group.
4. Spectrum Detroit Diesel.

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated.
 - 2. Output Connections: Three-phase, four wire.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 - 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
 - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 - 7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

2.3 ENGINE

- A. Fuel: Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1800 rpm.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

- D. Lubrication System: The following items are mounted on engine or skid:
1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Engine Fuel System:
1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Governor: Mechanical.
- G. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- H. Muffler/Silencer: Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 18 dB at 500 Hz.
 2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 95 dBA or less.
 3. Discharge after installation is complete shall be 87 dBA or less.
- I. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

- J. Starting System: 24-V electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: 60 seconds.
 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

- A. Comply with NFPA 30.
- B. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:
1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

2. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 4 hours' operation at 100 percent of rated power output of engine-generator system without being refilled.
3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
5. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.
6. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.5 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 2 system, and the following:
 1. AC voltmeter.
 2. AC ammeter.
 3. AC frequency meter.
 4. DC voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch(es).
 9. Generator-voltage adjusting rheostat.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1. Tripping Characteristic: Designed specifically for generator protection.
 - 2. Trip Rating: Matched to generator rating.
 - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Comply with NEMA MG 1.
- C. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- D. Electrical Insulation: Class H or Class F.
- E. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- G. Enclosure: Dripproof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
- B. Description: Prefabricated or pre-engineered walk-in enclosure with the following features:
 - 1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
 - 2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.

3. Space Heater: Thermostatically controlled and sized to prevent condensation.
 4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 5. Hinged Doors: With padlocking provisions.
 6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
 7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
 8. Muffler Location: External to enclosure.
- C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
 2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.8 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene.
 2. Durometer Rating: 50.
 3. Number of Layers: Two.

2.9 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.10 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with elastomeric isolator pads having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. .
- D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

- A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

- B. Connect engine exhaust pipe to engine with flexible connector.
- C. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - 1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

- A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Exhaust Emissions Test: Comply with applicable government test criteria.
 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.
 - 2. Remote annunciation systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
 - 1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 018300 "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA ICS 1.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 110.
- I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Owner no fewer than Seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Contactor Transfer Switches:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AC Data Systems, Inc.
 - b. Caterpillar; Engine Div.
 - c. Emerson; ASCO Power Technologies, LP.
 - d. Generac Power Systems, Inc.
 - e. GE Zenith Controls.
 - f. Kohler Power Systems; Generator Division.
 - g. Onan/Cummins Power Generation; Industrial Business Group.
 - h. Russelectric, Inc.
 - i. Spectrum Detroit Diesel.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- H. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- I. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- J. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- L. Enclosures: General-purpose NEMA 250, Type 3R complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
- G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- H. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
- I. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
- J. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.
- K. Automatic Transfer-Switch Features:
 - 1. Under voltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- B. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- C. Identify components according to Section 260553 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

- a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
- a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
- a. Verify grounding connections and locations and ratings of sensors.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
- B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 412213 - BRIDGE CRANES AND MONORAILS, UNDERHUNG, HAND OPERATED

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. The requirements for the crane runway system supporting structures are specified in Section 055000 Metal Fabrications.

1.2 DEFINITIONS

- A. Crane Bridge: that part of an overhead crane system consisting of girders, end trucks, end ties, walkway, and drive mechanism which carries the trolleys and travels along the runway rails parallel to the runway.
- B. Crane Runway: The track system along which the crane operates horizontally, including track hangar rods, track connection devices, and runway structural supports.
- C. Dead Loads: The loads on a structure which remain in a fixed position relative to the structure.
- D. Girder: The principal horizontal beam of the crane bridge. It is supported by the crane end trucks.
- E. Live Load: A load which moves relative to the structure under consideration.
- F. Rated Load: For the purpose of this specification the rated load is defined as the maximum working load suspended under the load hook.
- G. Standard Commercial Cataloged Product: A product which is currently being sold, or previously has been sold, in substantial quantities to the general public, industry or Government in the course of normal business operations. Models, samples, prototypes or experimental units do not meet this definition. The term "cataloged" as specified in this section is defined as "appearing" on the manufacturer's published product data sheets. These data sheets must have been published or copyrighted prior to the issue date of this solicitation and have a document identification number or bulletin number.
- H. Underhung Crane: An overhead traveling crane that is supported by crane end trucks suspended below the crane running. The load is supported by hanging from the lower flange of a beam.
- I. Trolley: A wheeled trolley that provides horizontal motion along the bridge girder or monorail.

1.3 VERIFICATION OF DIMENSIONS

- A. The Contractor is responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane before finalizing the crane order.

1.4 ACTION SUBMITTALS

- A. Product Data: trolley.
- B. Shop Drawings: Underhung, hand operated crane and monorail.
- C. Test Reports: Post-erection inspection, operational tests, no-load test, load tests
- D. Operation and Maintenance Data: Underhung, hand operated crane and monorail.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualification: Crane system, including sub-system components manufactured by vendors, must be designed and manufactured by a company with a minimum of 10 years of specialized experience in designing and manufacturing the type of overhead crane required to meet requirements of the Contract Documents.
- B. Pre-Delivery Inspections: Contractor is responsible for performance of quality control inspections, testing and documentation of bridge and trolley.
- C. Drawings: Submit shop drawings showing the general arrangement of all components in plan, elevation, and end views, clearances and principal dimensions and assemblies of trolley and bridges. Include weights of components and maximum bridge wheel loads and spacing. Provide integral schedule of crane components on each drawing. Provide maximum wheel loads (without impact) and spacing imparted to the crane runway system track beams.
- D. Design Data: Load and Sizing Calculations: Submit calculations reviewed verifying the sizing of the bridge girder and end trucks.
- E. Welding Qualifications and Procedures: Welding must be in accordance with qualified procedures using AWS D14.1/D14.1M as modified. Written welding procedures must specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and not exceed those specified in AWS D14.1/D14.1M and CMAA 74. Welders and welding operators must be qualified in accordance with AWS D1.1/D1.1M or AWS D14.1/D14.1M. Allowable stress values must comply with CMAA 74.

1.6 CRANE SAFETY

- A. Comply with the mandatory and advisory safety requirements of ASME B30.10, and NFPA 70.

PART 2 - PRODUCTS

2.1 UNDERHUNG, HAND OPERATED CRANE SYSTEM

- A. Provide underhung, hand operated cranes conforming to CMAA 74, Class C (Moderate Service) for indoor service, ASME B30.2, with a crane span as indicated. The crane must operate in the spaces and within the loading conditions indicated. Maximum crane wheel loads (without impact) due to dead and live loads, with the trolley in any position, must not cause a more severe loading condition in the runway support structure than that produced by the design wheel loads and spacing indicated. Submit operations and maintenance data, including recommended maintenance items on a weekly, monthly, semi-annual, and annual basis.
- B. Capacity: Provide cranes with a minimum 2 ½ ton ultimate capacity.
- C. Crane Runway Girders and Monorail: Crane runway girder and monorail designs are indicated. Proprietary or alternate items may be substituted providing that their design will sustain the indicated capacity and fits within the same clearance envelope. Submit calculations for proprietary or alternate items.
- D. Crane Runway Girders and Monorail: Crane runway girder and monorail designs are indicated. Proprietary or alternate items may be substituted, providing that their design will sustain the indicated capacity and fits within the same clearance envelope. Submit calculations for proprietary or alternate items.
- E. Crane Safety: Comply with the mandatory and advisory safety requirements of ASME B30.2, CMAA 74, 29 CFR 1910.147, 19 CFR 1910.179, 29 CFR 1910.306, and all applicable provisions of 29 CFR 1910.

2.2 STRUCTURAL REQUIREMENTS

- A. Structural requirements must be in accordance with CMAA 70, Section 3.

2.3 MECHANICAL EQUIPMENT

- A. Provide steel shafts, keys, and couplings. All bearings, except those subject only to small rocker motion, must be anti-friction type.

2.4 CRANE PAINTING

- A. Provide primer and finish coat. Finish coat shall be brilliant yellow. Coat faying surfaces of bolted connections per AISC 325, but do not apply finish paint.

2.5 IDENTIFICATION PLATES

- A. Furnish and install identification plates. Provide non-corrosive metal identification plates with clearly legible permanent lettering giving the manufacturer's name, model number, serial number, capacity pound units, and other essential information or identification.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Erect and install the crane and monorail, complete in accordance with the approved submittals and in condition to perform the operational and acceptance tests.

3.2 ERECTION SERVICES

- A. The crane manufacturer must provide supervisory erection services.

3.3 FIELD QUALITY CONTROL

- A. Post-Erection Inspection: After erection, the Contractor and Owner shall jointly inspect the crane bridge and hoist systems and components to determine compliance with specifications and approved submittals. Notify the Owner 3 days before the inspection. Provide a report of the inspection indicating the crane is considered ready for operational tests.
- B. Operational Tests: Check the clearance envelope of the entire crane prior to picking or traversing any load to ensure there are no obstructions. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the crane is operational. The Contractor must furnish test loads, operating personnel, instruments, and other apparatus necessary to conduct field tests on each crane.
- C. Test Data: Record test data on appropriate test record forms suitable for retention for the life of the crane.
- D. No-Load Test: Operate the bridge and trolley in each direction the full distance between end stops. Assure that the trolley and crane may be moved by hand with ordinary effort.
- E. Load Tests: Perform the following tests, as specified, with test loads of 100 percent (plus 0 minus 10) of rated load.
- F. Bridge: Apply a test load of 100 percent of rated load on the trolley in 25% increments with the trolley located mid span of the girder and the bridge located in mid span of a runway span and measure deflection, comparing with predicted deflection. Check for any binding of the bridge end trucks. Record deficiencies. Secure from testing if deficiencies are found.

END OF SECTION 412213



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