



COUNTY OF GALVESTON

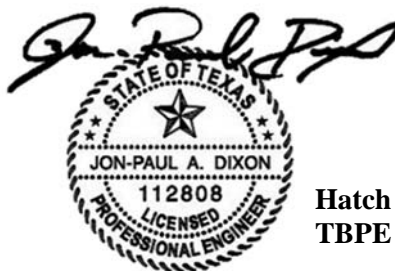
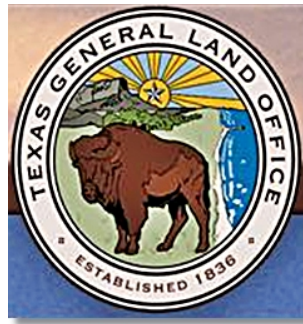
SPECIFICATIONS AND CONTRACT DOCUMENTS

SAN LEON MUD MOTOR CONTROL CENTER

BID # B181051

GLO CONTRACT NO. 12-403-005

PROJECT NO. P21474



**Hatch Associates Consultants, Inc.
TBPE No. F-314**

May 9, 2018

HATCH

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**GALVESTON COUNTY
PURCHASING DEPARTMENT**



INVITATION TO BID

BID #B181051

SAN LEON MUD MOTOR CONTROL CENTER

BID DUE DATE: 07/17/2017

2:00 P.M.

***Rufus Crowder, CPPO, CPPB
Purchasing Agent
Galveston County
722 Moody (21st Street)
Fifth (5th) Floor
Galveston, Texas 77550
(409) 770-5372***

ITB #B181051
OPENING: 07/17/2018
TIME: 2:00 P.M.



**INVITATION TO BID
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS**

The County of Galveston solicits bids on the following project funded through the Texas General Land Office, contract number 13-465-000-7974, Hurricane Ike disaster recovery program funds.

Sealed bids in **sets of four (4), one (1) original and three (3) copies**, will be received in the office of the Galveston County Purchasing Agent **until 2:00 P.M. CST, on Tuesday, July 17, 2018** and opened immediately in that office in the presence of Galveston County Auditor and the Purchasing Agent. Sealed qualifications are to be delivered to Rufus G. Crowder, CPPO CPPB, Galveston County Purchasing Agent at the Galveston County Courthouse, 722 Moody, (21st Street), Floor 5, Purchasing, Galveston, Texas 77550, (409) 770-5372. **The time stamp clock located in the Purchasing Agent's office shall serve as the official time keeping piece for this solicitation process. Any bid received after 2:00 P.M. CST on the specified date will be returned unopened.**

Purpose:

Work includes construction of a second floor mezzanine, build-out of the MCC room, HVAC, automatic emergency power transfer switch, conduits for the MCC and emergency power, associated appurtenances, and work associated with construction.

All bids must be marked on the outside of the envelope:

ITB #B181051

San Leon MUD Motor Control Center

Bidder's name, return address, should be prominently displayed on the bid package for identification purposes.

Specifications can be obtained by visiting the Galveston County website @

<http://www.galvestoncountytexas.gov/pu/Pages/BidListings.aspx>.

Submitted prices shall be either lump sum or unit prices as shown on bid sheets, if applicable. The net price shall be delivered to Galveston County, including all freight, shipping, and license fees. Galveston County is tax exempt and no taxes should be included in bid pricing.

A non-mandatory pre-bid conference will be held on Wednesday, June 27, 2018 at 10:00 a.m. at the Galveston County Courthouse, Purchasing Department, 722 Moody (21st Street), Fifth (5th) Floor, Galveston, Texas 77550.

Copies of bid/Contract Documents may also be obtained from www.Civcast.com search San Leon MUD Motor Control Center. Bidders must register on this website in order to view and/or download specifications and plans for this project. There is NO charge to view or download documents. If copies of the bidding documents are to be mailed, please contact HATCH at 713-467-9961 for postage and handling. Return of documents is not required and no refund will be granted.

ITB #B181051
OPENING: 07/17/2018
TIME: 2:00 P.M.

Upon satisfaction of contractual terms (e.g., goods delivered in promised condition, services rendered as agreed, etc.), contractor shall be paid via Galveston County's normal accounts payable process.

Bonding Requirements:

- **BID GUARANTEE:** Evidencing its firm commitment to engage in the contract if Bidder is selected for award of contract, each Bidder is required to furnish with their bid a Cashier's Check, or an acceptable Bidder's Bond, in the amount of five percent (5%) of the total contract price. The Bidder's Bond must be executed with a surety company authorized to do business in the State of Texas. Failure to furnish the bid/proposal guarantee in the proper form and amount, by the time set for opening of bids may be cause or rejection of the bid.
- **PERFORMANCE AND PAYMENT BONDS:** Successful bidder, before beginning work, shall execute a performance bond and a payment bond, each of which must be in the amount of the contract. The required payment and performance bonds must each be executed by a corporate surety in accordance with Section 1, Chapter 87, Acts of the 56th Legislature, Regular Session, 1959 (Article 7.19-1, Vernon's Texas Insurance Code).

Attention is called to the fact that not less than, the federally determined prevailing (Davis-Bacon and Related Acts) wage rate, as issued by the Office of Rural Community Affairs and contained in the contract documents, must be paid on this project. In addition, the successful bidder must ensure that employees and applicants for employment are not discriminated against because of race, color, religion, sex age or national origin.

The Galveston County Commissioners' Court reserves the right to waive any informality and to reject any and all bids and to accept the bid or bids which, in its opinion, is most advantageous to Galveston County with total respect the governing laws.

All contractors/subcontractors that are debarred, suspended or otherwise excluded from or ineligible for participation on federal assistance programs may not undertake any activity in part or in full under this project

Rufus G. Crowder, CPPO CPPB
Purchasing Agent
Galveston County

INVITATION TO BID
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS

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**GENERAL PROVISIONS – INVITATION TO BID
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS**

1. BID PACKAGE

*The Invitation to Bid, general and special provisions, drawings, specifications/line item details, contract documents and the Bid sheet are all part of the Bid package. **BIDs must be submitted in sets of four (4), one (1) original and three (3) copies** on the forms provided by the County if County forms are provided, including the Bid sheets completed in their entirety and signed by an authorized representative by original signature. Failure to complete and sign the Bid sheets/contract page(s) may disqualify the Bid from being considered by the Commissioners' Court. Any individual signing on behalf of the Bidder expressly affirms that he or she is duly authorized to tender this Bid and to sign the Bid sheet/contract under the terms and conditions in this bid on behalf of the Bidder and to bind the Bidder to the terms and conditions of this bid and the Bidder's response hereto. Bidder further understands that its' signing of the contract shall be of no effect unless the contract is subsequently awarded by the Commissioners' Court and the contract properly executed by the Commissioners' Court. All figures must be written in ink or typed. Figures written in pencil or with erasures are not acceptable. However, mistakes may be crossed out, corrections inserted, and initialed in ink by the individual signing the bid. If there are discrepancies between unit prices quoted and extensions, the unit price shall prevail. Each Bidder is required to thoroughly review this entire Bid package to familiarize themselves with the Bid procedures, the plans and specifications for the requested work, as well as the terms and conditions of the contract the successful Bidder will execute with the County.*

2. BIDDER'S RESPONSIBILITY

The Bidder must affirmatively demonstrate its responsibility. The Bidder must also meet the following minimum requirements:

- A. have adequate financial resources or the ability to obtain such resources as required;
- B. be able to comply with all federal, state, and local laws, rules, regulations, ordinances and orders regarding this Invitation to Bid;
- C. have a satisfactory record of performance;
- D. have a satisfactory record of integrity and ethics; and
- E. be otherwise qualified and eligible to receive an award.

3. TIME FOR RECEIVING BIDS

Bids may be submitted by mail or hand delivery and **must be submitted to the Galveston County Purchasing Agent**. If by delivery, the Bidder must deliver to the reception desk in the County Purchasing Agent's Office. The delivery and mailing instructions for the Galveston County Purchasing Agent are the following:

**Rufus Crowder, CPPO CPPB
Galveston County Purchasing Agent
722 Moody, Fifth (5th) Floor
Galveston, Texas 77550**

Bids will **not** be accepted by facsimile transmission or by electronic mail (email) unless superseded by instructions within the Special Provisions sections of this solicitation. Bids must be received by the County Purchasing Agent on or before the deadline for the opening of the bids. For clarity, mailing date/postmark is **not** sufficient – bids **must be received** by the County Purchasing Agent on or before the deadline. Late bids will not be accepted and will be returned to the bidder unopened. Bids received prior to the submission deadline will be maintained unopened until the specified time for opening.

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SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS**

The County Purchasing Agent will accept bids from 8:00 a.m. to 5:00 p.m. on each business day up to the submission deadline. Business days do not include Saturdays and Sundays, and do not include other days in which the County is closed for business in observance of holidays or for other reasons.

The time-stamp clock within the County Purchasing Agent's Office shall be the official time-clock for the purpose of this solicitation and thus shall be the determinant of whether the bid was timely received.

The bidder should prominently identify the procurement number and name on the outside of the envelope/mailing package. A label shall be provided for this purpose and usage of the label is preferred. If the bidder fails to identify the bid on the outside of the envelope as required, the Purchasing Agent will open the envelope for the sole purpose of identifying the bid number for which the submission was made. The envelope will then be resealed. No liability will attach to a County office or employee for the premature opening of a bid.

If a bid is not submitted, return this Invitation to Bid and state reason (s), otherwise your name may be removed from the Purchasing Agent's mailing list.

4. COMPETITIVENESS, INTEGRITY, INQUIRIES AND QUESTIONS

To prevent biased evaluations and to preserve the competitiveness and integrity of the procurement process, **bidders are to direct all communications regarding this invitation to bid only to the Galveston County Purchasing Agent**, unless otherwise specifically noted.

Do not contact the requesting department. Attempts by offering firms to circumvent this requirement will be viewed negatively and may result in rejection of the bid of the firm found to be in non-compliance.

All questions regarding this Invitation to Bid must be submitted in writing to:

**Rufus Crowder, CPPO CPPB, Purchasing Agent
722 Moody
Fifth (5th) Floor
Galveston, Texas 77550
Fax: (409) 621-7997**

E-mail: rufus.crowder@co.galveston.tx.us

All questions received and the responses thereto will be mailed, emailed, or faxed to all prospective bidders by addendum. No inquiries except clarification of instructions will be addressed by telephone.

Bidder is advised to carefully review this Invitation to Bid – it provides specific information necessary to aid participating firms in formulating a thorough response. Bidder's failure to examine all documents shall not entitle the bidder to any relief from the conditions imposing in the Invitation to Bid and the resultant contract.

An authorized person from the bidder must sign the bid. This signatory must be a person from the submitting firm who is duly authorized to tender and sign the bid on behalf of the bidder and to bind the bidder to the terms and conditions of this Invitation to Bid, the bidder's response, and all other terms and conditions of the contract. By this signature, the bidder further acknowledges that the bidder has read the bid documents thoroughly before submitting a bid and will fulfill the obligations in accordance to the terms, conditions, and specifications detailed herein.

GENERAL PROVISIONS – INVITATION TO BID
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS

5. BID OPENING

The Purchasing Agent shall open the bids on the date and time specified herein. Information read aloud at the bid opening is at the sole discretion of the Purchasing Agent. The Purchasing Agent will examine bids promptly and thoroughly.

6. WITHDRAWAL OF BID

Bidders may request withdrawal of their sealed bid prior to the scheduled bid opening time provided the request for withdrawal is submitted to the Purchasing Agent in writing. No bids may be withdrawn for a period of sixty (60) calendar days after opening of the bids.

7. COMMISSIONERS' COURT

No contract is binding on the County until it is properly placed on the Commissioners' Court agenda, approved in open Court, authorized to be executed by the County Judge, and fully executed by both parties.

Department heads and elected officials are not authorized to enter into any type of agreement or contract on behalf of the County. Only the Commissioners' Court acting as a body may enter into a contract on behalf of and contractually bind the County. Additionally, department heads and elected officials are not authorized to agree to any type of supplemental agreements or contracts for goods or services. Supplemental agreements are subject to review by the County Legal Department prior to being accepted and signed by the County's authorized representative.

8. REJECTION OF BIDS/DISQUALIFICATION

Galveston County, acting through its Commissioners' Court, reserves the right to:

- reject any and all Bids in whole or in part received by reason of this Invitation to Bid;
- waive any informality in the Bids received;
- disregard the Bid of any Bidder determined to be not responsible; and/or;
- discontinue its efforts for any reason under this Bid package at any time prior to actual execution of contract by the County.

Bidders may be disqualified and rejection of Bids may be recommended to the Commissioners' Court for any of (but not limited to) the following causes:

- A. Failure to use the bid forms furnished by the County, if applicable;
- B. Lack of signature by an authorized representative of bidder;
- C. Failure to properly complete the bid;
- D. Failure to meet the mandatory requirements of this invitation to bid; and/or
- E. Evidence of collusion among bidders.

9. RESTRICTIVE OR AMBIGUOUS SPECIFICATIONS

It is the responsibility of the prospective Bidder to review the entire Invitation to Bid packet and to notify the Purchasing Agent if the specifications are formulated in a manner that would restrict competition or appear ambiguous. Any protest or question(s) regarding the specifications or Bid procedures must be received in the

GENERAL PROVISIONS – INVITATION TO BID
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS

Purchasing Agent's Office not less than seventy-two (72) hours prior to the time set for Bid opening. Bidders are to submit their Bid as specified herein or propose an approved equal.

10. SUBSTITUTES/DESCRIPTION OF MATERIALS AND EQUIPMENT

Any brand name or manufacturer reference used herein is intended to be descriptive and not restrictive, unless otherwise noted, and is used to indicate the type and quality of material. The term "or equal" if used, identifies commercially produced items that have the essential performance and salient characteristics of the brand name stated in the item description. All supplies, material, or equipment shall be new and of the most suitable grade for the purpose intended. For clarification, "new" includes products containing recovered materials that are EPA-designated items. It is not the County's intent to discriminate against any materials or equipment of equal merit to those specified. However, if Bidder desires to use any substitutions, prior written approval must be obtained from the Purchasing Agent and sufficiently in advance such that an addendum may be issued. All material supplied must be one hundred percent (100%) asbestos free. Bidder, by submission of its bid, certifies that if awarded any portion of this procurement, the bidder will supply only material and equipment that is 100% asbestos free.

11. EXCEPTIONS TO BID

The Bidder will list on a separate sheet of paper any exceptions to the conditions of the bid. This sheet will be labeled, "Exceptions to Bid Conditions", and will be attached to the bid. If no exceptions are stated, it will be understood that all general and specific conditions will be complied with, without exception.

The Bidder must specify in its Bid any alternatives it wishes to propose for consideration by the County. Each alternative should be sufficiently described and labeled within the Bid and should indicate its possible or actual advantage to the program being offered.

The County reserves the right to offer these alternatives to other Bidders.

12. PRICING

Bids will be either lump sum or unit prices as shown on the Bid sheet. The net priced items will be delivered to Galveston County, including all freight or shipping charges.

Cash discount must be shown on bid, otherwise prices will be considered net. Unless prices and all information requested are complete, Bid may be disregarded and given no consideration.

In case of default by the contractor, the County of Galveston may procure the articles or services from other sources and may deduct from any monies due, or that may thereafter become due to the contractor, the difference between the price named in the contract of purchase order and the actual cost thereof to the County of Galveston. Prices paid by the County of Galveston shall be considered the prevailing market price at the time such purchase is made. Periods of performance may be extended if the facts as to the cause of delay justify such extension in the opinion of the Purchasing Agent and the Commissioners' Court.

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13. PROCUREMENT CARD (P-CARD) PROGRAM

The County of Galveston participates in a Procurement Card (P-Card) program that allows payments made to a vendor by credit card. This method typically results in substantially faster bill payments, sometimes within three (3) to five (5) days of the actual transaction date. All transaction fees from the card provider are to be paid by the successful contractor. If your company will accept payment via credit card (Visa, MasterCard), please notate this in your Bid submittal.

14. PASS THROUGH COST ADJUSTMENTS

Except in instances of extreme extenuating circumstances Contractor prices shall remain firm throughout the contract period and any renewals. Examples of extreme extenuating circumstances include such situations as a nationwide rail strike, oil shortage or oil embargo.

In extreme extenuating circumstances, Contractors may be allowed to temporarily “pass through” additional costs they are forced to incur through no fault of their own. A request for a pass through cost increase will not be considered unless a Contractor’s cost for the Contractor’s product exceeds 10% over the original cost for the product. Also, the increase in cost must be nationwide and consistent for a minimum period of sixty (60) days. Costs that historically are anticipated to rise over a period of time (for example only, such as wages or insurance costs) do not qualify for pass through. If a Contractor thinks he will be asking for a pass through cost adjustment during the term of the contract, then the original cost of the product to Contractor must be stated in Contractor’s original bid.

A request for a pass through cost does not guarantee that one will be granted. Contractors must submit such information on each request as required by the County Purchasing Agent. The County Purchasing Agent will review each request on a case-by-case basis and determine the appropriateness of each request as well as amount and duration of increase. Contractors will not be permitted any additional compensation for mark-ups or profits based on the increase in price. Rather, such additional compensation will be limited to the actual increase in original cost to the Contractor as such increase is reflected by the original cost stated in the bid. But in no event will the amount of additional compensation exceed 25% increase in Contractor’s original cost for the product as such cost is reflected in Contractor’s original Bid or the duration exceed a period of sixty (60) days. In addition should the cost, during the period of the pass through, return to normal or decrease to below pre pass through prices, appropriate downward adjustments shall be made. No more than one pass through adjustment will be permitted per year.

15. MODIFICATION OF BIDS

A Bidder may modify a bid by letter at any time prior to the submission deadline for receipt of Bids. Modification requests must be received prior to the submission deadline. Modifications made before opening time must be initialed by Bidder guaranteeing authenticity. Bids may not be amended or altered after the official opening with the single exception that any product literature and/or supporting data required by the actual specifications, if any, will be accepted at any time prior to the Commissioners’ Court considering of same.

16. SIGNATURE OF BIDS

Each Bid shall give the complete mailing address of the Bidder and be signed by an authorized representative by original signature with the authorized representative’s name and legal title typed below the signature line. Each bid shall include the Bidder’s Federal Employer Identification Number (FEIN). Failure to sign the Contract page(s) and bid response sheets may disqualify the bid from being considered by the County. The person signing on behalf of the Bidder expressly affirms that the person is duly authorized to tender the bid and to sign the bid sheets and contract

**GENERAL PROVISIONS – INVITATION TO BID
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under the terms and conditions of this Invitation to Bid and to bind the Bidder thereto and further understands that the signing of the contract shall be of no effect until it is properly placed on the Commissioners' Court agenda, approved in open Court, authorized to be executed by the County Judge, and fully executed by both parties.

17. AWARD OF BIDS – EVALUATION CRITERIA AND FACTORS

The award will be made to the responsible Bidder whose bid is determined to be the lowest and best evaluated offer demonstrating the best ability to fulfill the requirements set forth in this Invitation to Bid. **The proposed cost to the County will be considered firm and cannot be altered after the submission deadline.**

“Lowest and best” means a bid or offer providing the best value considering associated direct and indirect costs, including transport, maintenance, reliability, life cycle, warranties, and customer service after a sale.

Each Bidder, by submitting a bid, agrees that if its' bid is accepted by the Commissioners' Court, such Bidder will furnish all items and services upon which prices have been tendered and upon the terms and conditions in this bid and contract.

The contractor shall commence work only after the transmittal of a fully executed contract and after receiving written notification to proceed from the County Purchasing Agent. The contractor will perform all services indicated in the bid in compliance with this contract.

Neither department heads nor elected officials are authorized to sign any binding contracts or agreements prior to being properly placed on the Commissioners' Court agenda and approved in open court. Department heads and other elected officials are not authorized to enter into any type of agreement or contract on behalf of Galveston County. Only the Commissioners' Court, acting as a body, may enter into a contract on behalf of the County. Additionally, department heads and other elected officials are not authorized to agree to any type of supplemental agreements or contracts for goods or services. Supplemental agreements are subject to review by the County Legal Department prior to being signed by the County's authorized representatives.

The County of Galveston reserves the right to accept bids on individual items listed, or group items, or on the bid as a whole; to reject any and all bids; to waive any informality in the bids; and to accept the bid that appears to be in the best interest of the County. The selection process may, however, include a request for additional information or an oral presentation to support the written bid.

In determining and evaluating the best bid, the pricing may not necessarily be controlling, but quality, equality, efficiency, utility, general terms, delivery, suitability of the service offered, and the reputation of the service in general use will also be considered along with any other relevant items. The Commissioners' Court shall be the sole judge in the determination of these matters.

The County reserves the right to reject any or all Bids in whole or in part received by reason of this Invitation to Bid and may discontinue its efforts under this Invitation to Bid for any reason or no reason or solely for the County's convenience at any time prior to actual execution of the contract by the County.

A Bidder whose bid does not meet the mandatory requirements set forth in this Invitation to Bid may be considered non-compliant.

The invitation to submit a bid which appears in the newspaper, or other authorized advertising mediums, these general provisions, the specifications which follow, the Bid sheets, and any addenda issued are all considered part of the Bid.

**GENERAL PROVISIONS – INVITATION TO BID
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS**

Each Bidder, by submitting a bid, agrees that if its bid is accepted by the Commissioners' Court, such Bidder will furnish all items and services upon the terms and conditions in this Invitation to Bid and the resultant contract.

Notice of contract award will be made within ninety (90) days of opening of Bids to the lowest responsive and responsible contractor, whose bid complies with all the requirements in the Invitation to Bid.

Contractor shall submit to the County, for approval, within ten (10) days from notice of contract award, all Certificates of Insurance evidencing the required coverage as described under Section 35, Requirement of and Proof of Insurance.

The contractor shall not commence work under these terms and conditions of the contract until all applicable Certificates of Insurance, Performance and Payment Bonds, and Irrevocable Letters of Credit (if required) have been approved by the County of Galveston and the Contractor has received notice to proceed in writing and an executed copy of the contract from the County Purchasing Agent.

18. DISPUTE AFTER AWARD/PROTEST

Any actual or prospective Bidder who is allegedly aggrieved in connection with the solicitation of this Invitation to Bid or award of a contract resulting therefrom may protest. The protest shall be submitted in writing to the Purchasing Agent within seven (7) calendar days after such aggrieved person knows of or should have known of the facts giving rise thereto. If the protest is not resolved by mutual agreement, the Purchasing Agent will promptly issue a decision in writing to the protestant. If the protestant wishes to appeal the decision rendered by the Purchasing Agent, such appeal must be made to the Commissioners' Court through the Purchasing Agent. The decision of the Commissioners' Court will be final. The Commissioners' Court need not consider protests unless this procedure is followed.

19. PUBLIC INFORMATION ACT (f/k/a Open Records Act)

The bidder acknowledges that the County is a government body for purposes of the Public Information Act, codified as Chapter 552 of the Texas Government Code, and as such is required to release information in accordance with the provisions of the Public Information Act.

If bidder considers any of its submitted information to be proprietary in nature, trade secret, or otherwise confidential, then it must clearly and conspicuously mark such information as proprietary, trade, secret, or confidential. By the submission of its bid, Bidder expressly affirms that it has clearly and conspicuously marked any information within its submission that Bidder considers confidential, proprietary, and/or trade secret.

In the event the County receives a request for information under the Public Information Act seeking information that the Bidder has marked as confidential, proprietary, and /or trade secret, then the County agrees that it shall provide notice to the Bidder of the request for information and the request for decision process under the Public Information Act. Thus, the County will submit the initial correspondence to the Texas Attorney General – however, the burden is and shall be on the Bidder to submit correspondence to the Attorney General if the Bidder wishes its information to be withheld. Bidder is deemed to have knowledge of the Public Information Act. **By the submission of its bid, bidder expressly acknowledges that the burden to withhold its' information from public disclosure lays with the bidder;** thus, bidder further acknowledges and agrees that it shall submit comments to the Texas Attorney General in the request for decision process if bidder wishes to have its' information withheld from public disclosure.

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20. BIDDER'S E-MAIL ADDRESSES – CONSENT TO DISCLOSURE

Notwithstanding the foregoing Section 19, Bidder acknowledges and agrees that the confidentiality of any and all email addresses Bidder uses or discloses in communicating with the County are **open** to the public in accordance with Section 552.137 of the Government Code and Bidder consents to the release of its email addresses.

21. RESULTANT CONTRACT

Bidder shall correctly and fully execute the resultant contract first. After this, the contract shall be set for consideration by the Commissioners' Court. If the Commissioners' Court authorizes the execution of the contract, the resultant contract shall become effective upon the Commissioners' Court execution of same. Contract documents shall consist of the contract, the General and Special Provisions, drawings, bid package (including best and final offer(s) if such is utilized), any addenda issued, and any change orders issued during the work. If applicable to the attached bid, bidder must sign three (3) original contracts and return all three with their bid submittal.

Bidder should submit a proposed contract with its Bid or its sample material terms and conditions for review and consideration.

22. CONTRACT TERM

The term of the resultant contract will begin on the date of full execution or the execution by the Commissioners' Court, whichever is later, and will terminate on the date specified in the resultant contract unless terminated earlier as herein set forth.

23. TERMINATION FOR DEFAULT

Failure of either party in the performance of any of the provisions of this contract shall constitute a breach of contract, in which case either party may require corrective action within ten (10) business days from date of receipt of written notice citing the exact nature of such breach. Failure of the party being notified to take corrective action within the prescribed ten (10) business days, or failure to provide written reply of why no breach has occurred, shall constitute a Default of Contract.

All notices relating to default by Bidder of the provisions of the contract shall be issued by County by its Legal Department, and all replies shall be made in writing to the County Legal Department. Notices issued by or issued to anyone other than the County Legal Department shall be null and void and shall be considered as not having been issued or received.

Galveston County reserves the right to enforce the performance of this contract in any manner prescribed by law in the event of breach or default of this contract, and may contract with another party, with or without solicitation of bids or further negotiations. At a minimum, Bidder shall be required to pay any difference in service or materials, should it become necessary to contract with another source, plus reasonable administrative costs and attorney fees.

In the event of Termination for Default, Galveston County, its agents or representatives shall not be liable for loss of any profits anticipated to be made by Bidder.

In addition to the remedies stated herein, the County has the right to pursue other remedies permitted by law or in equity.

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No waiver by either party of any event of default under this agreement shall operate as a waiver of any subsequent default under the terms of this agreement.

County reserves the right to terminate this contract immediately in the event Bidder:

- A. Fails to meet delivery or completion schedules; and/or
- B. Fails to otherwise perform in accordance with the accepted Bid and the contract.

24. TERMINATION FOR CONVENIENCE

County may terminate this contract upon at least thirty (30) calendar days prior written notice for its convenience or for any reason deemed by the County to serve the public interest. As well, County may terminate this contract upon thirty (30) calendar days prior written notice for any reason resulting from any governmental law, order, ordinance, regulation, or court order. In no event shall County be liable for loss of any profits anticipated to be made hereunder by Bidder should this contract be terminated early.

25. FORCE MAJEURE

If by reason of Force Majeure either Party shall be rendered unable, wholly or in part, to carry out its responsibilities under this contract by any occurrence by reason of Force Majeure, then the Party unable to carry out its responsibility shall give the other Party notice and full particulars of such Force Majeure in writing within a reasonable time after the occurrence of the event, and such notice shall suspend the Party's responsibility for the continuance of the Force Majeure claimed, but for no longer period.

Force Majeure means acts of God, floods, hurricanes, tropical storms, tornadoes, earthquakes, or other natural disasters, acts of a public enemy, acts of terrorism, sovereign conduct, riots, civil commotion, strikes or lockouts, and other causes that are not occasioned by either Party's conduct which by the exercise of due diligence the Party is unable to overcome and which substantially interferes with operations.

26. ESTIMATED QUANTITIES

Any reference to quantities shown in the Invitation to Bid is an estimate only. Since the exact quantities cannot be predetermined, the County reserves the right to adjust quantities as deemed necessary to meet its requirements.

27. CONTRACTOR INVESTIGATION

Before submitting a bid, each Bidder shall make all investigations and examinations necessary to ascertain all site conditions and requirements affecting the full performance of the contract and to verify any representations made by the County upon which the contractor will rely. Bidder shall exercise due diligence and is further charged with knowledge of the local, State, and Federal laws, rules, and regulations applicable to this contract. If the bidder receives an award as a result of its bid submission in this procurement, the bidder's failure to have made such investigations and examinations will in no way relieve the bidder from its obligation to comply in every detail with all provisions and requirements of the contract, nor will a plea of ignorance of such conditions and requirements be accepted as a basis for any claim whatsoever by the contractor for additional compensation and/or for excused nonperformance.

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28. NO COMMITMENT BY COUNTY OF GALVESTON

This Invitation to Bid does not commit the County of Galveston to award any costs or pay any costs, or to award any contract, or to pay any costs associated with or incurred in the preparation of a bid in response to this Invitation to Bid and does not commit the County of Galveston to procure or contract for services or supplies.

29. BID COSTS BORNE BY BIDDER

Galveston County shall not be liable for any costs incurred by Bidder in preparation, production, or submission of a bid, including but not limited to best and final offer if applicable. As well, Galveston County shall not be liable for any work performed by Bidder prior to issuance of fully executed contract and properly issued notice to proceed. Galveston County shall not be liable for any costs incurred by Bidder by reason of attending a pre-Bid conference. Galveston County shall not be liable for any costs incurred by Bidder by reason of the County invoking use of best and final offers.

30. SINGLE BID RESPONSE

If only one bid is received in response to the Invitation to Bid, a detailed cost bid may be requested of the single bidder. A cost/price analysis and evaluation and/or audit may be performed of the cost bid in order to determine if the price is fair and reasonable.

31. CHANGES IN SPECIFICATIONS

If it becomes necessary to revise any part of this bid, a written notice of such revision will be provided to all Bidders in the form of addenda. The County is not bound by any oral representations, clarifications, or changes made in the written specifications by the County's employees or officials, unless such clarification or change is provided to Bidders in a written addendum from the Purchasing Agent. Bidders are advised to inquire prior to the submission deadline as to whether any addenda to this invitation to bid have been issued, as the successful bidder will be required to abide by such addenda.

The County of Galveston reserves the right to revise or amend the specifications up to the time set for opening of bids. Such revisions and amendments, if any, shall be announced by form of addenda. Copies of such addenda (or addendum in the event only one addendum is issued in the procurement) shall be furnished to all prospective contractors. Prospective contractors are defined as those contractors listed on the County's Invitation to Bid list for this material/service or those who have obtained documents subsequent to the advertisement. If revisions and amendments require changes in quantities or prices proposed, or both, the date set for opening of bids may be postponed by such number of days as in the opinion of the County shall enable contractors to revise their bids. In any case, the bid opening shall be at least seven (7) business days after the last revising or amendment addendum and the addendum shall include an announcement of the new date, if applicable, for the opening or bids.

32. BID IDEAS AND CONCEPTS

The County reserves to itself the right to adopt or use for its benefit, any concept, plan, or idea contained in any bid.

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33. BID DISCLOSURES

While this procurement is pending, the names of those who submitted bids will not be made public unless in conformity with the County Purchasing Act. Likewise, no pricing or staffing information will be released unless in conformity with the County Purchasing Act. Bidders are requested to withhold all inquiries regarding their bid or other submissions until after an award is made. No communication is to be had with any County employee or official, other than the County Purchasing Agent, regarding whether a bid was received - violations of this provision may result in the rejection of a bid.

34. INDEMNIFICATION

The contractor shall agree to assume all risks and responsibility for, and agrees to indemnify, defend, and save harmless, the County of Galveston, its elected and appointed officials and department heads, and its agents and employees from and against all claims, demands, suits, actions, recoveries, judgments, and costs and expenses including reasonable attorney's fees for the defense thereof in connection therewith on account of the loss of life, property or injury or damage to the person which shall arise from contractor's operations under this contract, its use of County facilities and/or equipment or from any other breach on the part of the contractor, its employees, agents or any person(s), in or about the County's facilities with the expressed or implied consent of the County. Contractor shall pay any judgment with cost which may be obtained against Galveston County resulting from contractor's operations under this contract.

Contractor agrees to indemnify and hold the County harmless from all claims of subcontractors, laborers incurred in the performance of this contract. Contractor shall furnish satisfactory evidence that all obligations of this nature herein above designated have been paid, discharged or waived. If Contractor fails to do so, then the County reserves the right to pay unpaid bills of which County has written notice direct and withhold from Contractor's unpaid compensation a sum of money reasonably sufficient to liquidate any and all such lawful claims.

35. REQUIREMENT OF AND PROOF OF INSURANCE

The successful Bidder shall furnish evidence of insurance to the County Purchasing Agent and shall maintain such insurance as required hereunder or as may be required in the Special Provisions or resultant contract, if different. Contractor shall obtain and thereafter continuously maintain in full force and effect, commercial general liability insurance, including but not limited to bodily injury, property damage, and contractual liability, with combined single limits as listed below or as may be required by State or Federal law, whichever is greater.

- A. For damages arising out of bodily injury to or death of one person in any one accident :
ONE HUNDRED THOUSAND AND NO/100 (\$100,000.00) DOLLARS.
- B. For damages arising out of bodily injury to or death of two or more persons in any one accident:
THREE HUNDRED THOUSAND AND NO/100 (\$300,000.00) DOLLARS.
- C. For any injury to or destruction of property in any one accident :
ONE HUNDRED THOUSAND AND NO/100 (\$100,000.00) DOLLARS.

Insurance shall be placed with insurers having an A.M. Best's rating of no less than A. Such insurance must be issued by a casualty company authorized to do business in the State of Texas, and in standard form approved by the

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Board of Insurance Commissioners of the State of Texas, with coverage provisions insuring the public from loss or damage that may arise to any person or property by reason of services rendered by Contractor.

Galveston County shall be listed as the additional insured on policy certificates and shall be provided with no less than thirty (30) calendar days prior notice of any changes to the policy during the contractual period.

Certificates of Insurance, fully executed by a licensed representative of the insurance company written or countersigned by an authorized Texas state agency, shall be filed with the County Purchasing Agent within ten (10) business days of issuance of notification from the County Purchasing Agent to Bidder that the contract is being activated as written proof of such insurance and further provided that Bidder shall not commence work under this contract until it has obtained all insurance required herein, provided written proof as required herein, and received written notice to proceed issued from the County Purchasing Agent.

Proof of renewal/replacement coverage shall be provided prior to the expiration, termination, or cancellation date of any policy. Said insurance shall not be cancelled, permitted to expire, or changed without at least thirty (30) days prior written notice to the County.

Insurance required herein shall be maintained in full force and effect during the life of this contract and shall be issued on an occurrence basis. Contractor shall require that any and all subcontractors that are not protected under the Contractor's own insurance policies take and maintain insurance of the same nature and in the same amounts as required of Contractor and provide written proof of such insurance to Contractor. Proof of renewed/replacement coverage shall be provided prior to the expiration, termination, or cancellation date of any policy. Contractor shall not allow any subcontractor to commence work on the subcontract until such insurance required for the subcontractor has been obtained and approved.

Workers' Compensation Insurance: Successful Bidder shall carry in full force Workers' Compensation Insurance Policy(ies), if there is more than one employee, for all its' employees, including but not limited to full time, part time, and emergency employees employed by the successful Bidder. Current insurance certificates certifying that such policies as specified above are in full force and effect shall be furnished by successful Bidder to the County.

Insurance is to be placed with insurers having a Best rating of no less than A. The Bidder shall furnish the County with certificates of insurance and original endorsements affecting coverage required by these insurance clauses within ten (10) business days of receiving notification from the County Purchasing Agent that the contract is being activated. The certificates and endorsements for each insurance policy are to be signed by a person authorized by the insurer to bind coverage on its behalf. The Bidder shall be required to submit annual renewals for the term of this contract prior to expiration of any policy.

In addition to the remedies stated herein, the County has the right to pursue other remedies permitted by law or in equity.

The County agrees to provide Bidder with reasonable and timely notice of any claim, demand, or cause of action made or brought against the County arising out of or related to utilization of the property. Bidder shall have the right to defend any such claim, demand, or cause of action at its sole cost and expense and within its sole and exclusive discretion. The County agrees not to compromise or settle any claim or cause of action arising out of or related to the utilization of the property without the prior written consent of the Bidder.

In no event shall the County be liable for any damage to or destruction of any property belonging to the Bidder.

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Subrogation Waiver. Bidder and Bidder's insurance carrier waive any and all rights to subrogation against Galveston County in regard to any suit or claim arising out of personal injury or property damage resulting from Bidder's performance under this agreement.

36. BID GUARANTEE

Unless specified differently within the Special Provisions of this procurement, each Bidder shall be required to submit a bid guarantee with its bid as required within this Section.

Evidencing its firm commitment to engage in contract if Bidder is selected for award of contract, each Bidder is required to furnish with their bid a cashier's check or an acceptable Bidder's bond in the amount of five percent (5%) of the total contract price. If Bidder is using a bond, then the Bidder bond must be executed with a surety company authorized to do business in the State of Texas. Failure to furnish the bid guarantee in the proper form and amount, by the time set for opening of bids may be cause for rejection of the bid.

The cashier's check or Bidder/bid bond (as applicable) will be returned to each respective unsuccessful Bidder(s) subsequent to the Commissioners Court award of contract, and shall be returned to the successful Bidder upon the completion and submission of all contract documents. Provided however, that the cashier's check or Bidder bond will be forfeited to the County as liquidated damages should successful Bidder fail to execute the contract within thirty (30) days after receiving notice of the acceptance of its bid.

37. PERFORMANCE AND PAYMENT BONDS (if required)

Successful Bidder, before beginning work, shall execute a performance bond and a payment bond, each of which must be in the amount of the contract. The required payment and performance bonds must each be executed by a corporate surety authorized to write surety bonds in the State of Texas and in accordance with Chapter 3503 of the Insurance Code (codified in 2005 and originally within Section 1, Chapter 87, Acts of the 56th Leg., R.S., 1959, and in Article 7.19-1, Vernon's Texas Insurance Code).

The performance and payment bonds must each clearly and prominently display on the bond or on an attachment to the bond:

- a.) The name, mailing address, physical address, and telephone number, including the area code, of the surety company to which any notice of claim should be sent; or
- b.) The toll-free telephone number maintained by the Texas Department of Insurance under Subchapter B, Chapter 521, Insurance Code, and a statement that the address of the surety company to which any notice of claim should be sent may be obtained from the Texas Department of Insurance by calling the toll free-telephone number.

The performance bond shall be solely for the protection of Galveston County, in the full amount of the contract, and conditioned on the faithful performance of the work in accordance with the plans, specifications, and contract documents. The payment bond is solely for the protection and use of payment bond beneficiaries who have a direct contractual relationship with the prime contractor or a subcontractor to supply labor or material, and in the amount of the contract.

The payment and performance bonds required to be furnished herein must be furnished before the contractor begins work and are a requirement for issuance of a Notice to Proceed. Such bonds must be furnished to the Galveston County Purchasing Agent within thirty (30) calendar days after the date of the full execution of the contract or, if applicable, as required under Chapter 2253, Government Code, whichever is earlier. Contractor's failure to provide the required payment and performance bonds within such time period shall constitute an event of default under this

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contract. Contractor shall not commence work until all applicable certificates of insurance, performance bonds, and payment bonds have been received and approved by the County Purchasing Agent and the Contractor receives notice to proceed in writing that has been issued by the County Purchasing Agent.

Additionally, if this request for bid is for the award of a public works contract, then compliance with Chapter 2253 of the Texas Government Code, which is known as the McGregor Act, is mandatory. Performance and payment bonds are required to be furnished in accordance with Chapter 2253 of the Texas Government Code. Bidder should familiarize itself with the entire provisions of Chapter 2253 of the Texas Government Code.

38. PATENT AND COPYRIGHT PROTECTION

The Bidder agrees at its sole expense to protect the County from claims involving infringement of patents, copyright, trademark, trade secret, or other intellectual property rights. **Bidder shall indemnify and save harmless the County of Galveston, its officers, employees, and agents, from liability of any nature and kind whatsoever, including without limitation cost and expenses, for or on account of any copyrighted, trademarked, trade secret, patented or un-patented invention, process, or article manufactured or used in the performance of the contract, or other intellectual property rights, including its use by the County.** Bidder also agrees that if Bidder is awarded this contract, that no work performed hereunder shall be subject to patent, copyright, or other intellectual property by Bidder.

39. CONFLICT OF INTEREST DISCLOSURE REPORTING (FORM CIQ)

Bidder may be required under Chapter 176 of the Texas Local Government Code to complete and file a conflict of interest questionnaire (CIQ Form). The CIQ Form pertains to business relationship, gift giving and family relationship reporting. IF bidder is required to file a CIQ Form, then the completed CIQ Form must be filed with the County Clerk of Galveston County, Texas.

Business relationship. If Bidder has an employment or other business relationship with a local government officer of Galveston County or with a family member of a local government officer of Galveston County that results in the officer or family member of the officer receiving taxable income that exceeds \$2,500.00 during the preceding 12-month period, then Bidder **MUST** complete a CIQ Form and file the original of the CIQ Form with the County Clerk of Galveston County.

Gift-giving. If Bidder has given a local government officer of Galveston County or a family member of a local government officer of Galveston County one or more gifts with an aggregate value of more than one-hundred dollars (\$100.00) during the preceding 12-months, then Bidder **MUST** complete a CIQ Form and file the original of the CIQ Form with the County Clerk of Galveston County.

Family member. For purposes of the business relationship and gift giving reporting requirements, a “family member” means a person related to another person with the first degree of consanguinity or affinity, as described by Subchapter B, Chapter 573, Texas Government Code. Examples of persons within the first degree by consanguinity or affinity include a son, daughter, father, mother, spouse, son-in-law, daughter-in-law, father-in-law, mother-in-law, stepson, stepdaughter, stepmother, and stepfather.

Family relationship. If Bidder has a “family relationship” with a local government officer of Galveston County then Bidder **MUST** complete a CIQ Form and file the original of the CIQ Form with the County Clerk of Galveston County, regardless of whether Bidder has a business relationship or has given gifts to the local government office or a family member of the local government officer. For this purpose, “family relationship” means Bidder is related within the third degree by consanguinity or the second degree by affinity, as those terms are defined under Chapter 573 of the Texas Government Code, to a local government officer of Galveston County. Examples of such relationships include

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a son, daughter, mother, father, brother, sister, grandchild, great-grandchild, grandparent, great-grandparent, niece, nephew, uncle, aunt, spouse, mother-in-law, father-in-law, daughter-in-law, son-in-law, spouse's grandchild, spouse's grandparent, grandparent's spouse, grandchild's spouse, stepson, stepdaughter, stepmother, and stepfather.

Bidder must file its original CIQ Form with the Galveston County Clerk. The Galveston County Clerk has offices at the following locations:

Galveston County Clerk

Galveston County Justice Center, Suite 2001
600 59th Street
Galveston, Texas 77551

Galveston County Clerk

North County Annex, 1st Floor
174 Calder Road
League City, Texas 77573

Again, if Bidder is required to file a CIQ Form, the original completed form is filed with the Galveston County Clerk (not the Purchasing Agent).

For Bidder's convenience, a blank CIQ Form is enclosed with this bid package. Blank CIQ Form(s) may also be obtained by visiting the Purchasing Agent's website – this website is linked from the Galveston County homepage, at <http://www.co.galveston.tx.us>.

Chapter 176 specifies deadlines for the filing of CIQ Forms (both initial filings and updated filings).

It is Bidder's sole responsibility to file a true and complete CIQ Form with the Galveston County Clerk if Bidder is required to file by the requirements of Chapter 176 of the Local Government Code. Bidder is advised that it is an offense to fail to comply with the disclosure reporting requirements dictated under Chapter 176 of the Texas Local Government Code, and the failure to file may be grounds to void the contract, if Bidder is awarded a contract.

If bidder has any questions about compliance with Chapter 176, Bidder may wish to consult its' legal counsel. Compliance is the individual responsibility of each person, business, and agent who is subject to Chapter 176 of the Texas Local Government Code.

40. DISCLOSURE OF INTERESTED PARTIES/FORM 1295

Under Section 2252.908 of the Government Code, any business entity that enters into a contract with Galveston County that requires the approval of the Commissioners Court must submit a "Disclosure of Interested Parties" to the County prior to the execution of the contract. This form, the "Disclosure of Interested Parties" form was promulgated by the Texas Ethics Commission, and is the "Form 1295". **This procurement is subject to these requirements.**

The Texas Ethics Commission was charged with promulgating rules to implement Section 2252.908 of the Government Code. The rules adopted by the Texas Ethics Commission are located at Sections 46.1, 46.3, and 46.5 of Title 1 of the Texas Administrative Code. Thus, the law covering these requirements is located at Section 2252.908 of the Government Code, and in Title 1, Sections 46.1, 46.3, and 46.5 of the Texas Administrative Code.

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The Texas Ethics Commission's website is: www.ethics.state.tx.us. The area of the Texas Ethics Commission website pertaining to Form 1295 is:

www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm.

Form 1295 must be completed electronically through the Texas Ethics Commission website (handwritten forms are not allowable). Once the business entity has completed their electronic filing of Form 1295, then the business entity must print out the electronically completed form, and sign and notarize the Form 1295. Once Form 1295 is signed and notarized, the business entity must submit their completed, signed, and notarized Form 1295 to the Galveston County Purchasing Agent.

Successful Proposer is and shall be subject to these requirements, and no resultant contract may be executed by the Commissioners Court until the completed, signed, and notarized Form 1295 is on file with the County Purchasing Agent.

No portion of the Form 1295 process commits the County to any type of award of contract whatsoever.

After the Purchasing Agent's Office receives the completed, signed, and notarized Form 1295, the Purchasing Agent's Office will, within 30 days, go the Texas Ethics Commission website to submit electronic confirmation of the County's receipt of the completed, signed, and notarized Form 1295.

41. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS & REQUIREMENT TO REGISTER IN SAM

Bidder certifies that neither it, nor any of its Principals, are presently debarred, suspended, proposed for debarment, disqualified, excluded, or in any way declared ineligible for the award of contracts by any Federal agency. Contractor agrees that it shall refund Galveston County for any payments made to Contractor while ineligible. Contractor acknowledges that Contractor's uncured failure to perform under this Agreement, if such should occur, may result in Contractor being debarred from performing additional work for the County, the respecting State Agency administering the grant funding the contract, if applicable, the State, FEMA or HUD (as applicable), and other Federal and State entities. Further, Bidder has executed the Certification Regarding Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters and returned the fully completed and executed original certification with the submission of its bid. **The truthful and fully completed and executed original of the Certification Regarding Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters must be included with the submission of Bidder's Bid and is a mandatory requirement of this Invitation to Bid. Bidder's failure to include the fully completed and executed original of this Certification shall be considered non-compliance with the requirements of this Invitation to Bid and grounds for the rejection of Bidder's Bid.** Proposer shall immediately notify the County Purchasing Agent if it becomes debarred or suspended, placed on the Consolidated List of Debarred Contractors, or in any other way becomes ineligible for award of contract by any Federal agency. This Certification is a material fact relied upon by Galveston County; if it is later determined that the contractor did not comply with 2 C.F.R. Part 180 and 2 C.F.R. Part 3000, in addition to the remedies available to Galveston County and the State agency administering this grant, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment of contractor.

If the contract to be awarded pursuant to this procurement involves the use of Federal funds, then bidder must also be registered in the Federal Contractor Registry through the System for Award Management (SAM) to be eligible for award of contract pursuant to this procurement.

Information regarding the SAM is available at:

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<http://www.federalcontractorregistry.com/?gclid=CIG1hf2rr8wCFYkCaQoducANZw> or at
<https://www.sam.gov/portal/SAM/#1>.

No contract involving the use of Federal funds may be awarded to any bidder unless and until such registration is current and in good standing under SAM. Successful bidder must maintain SAM registration throughout the entire term of the agreement with the County. If this contract involves the use of Federal funds, then bidder must enclose proof of such SAM registration within its response, which is also a mandatory requirement of this procurement; failure to enclose such proof shall be considered non-compliance with the requirements of this procurement and grounds for the rejection of bidder's response to this procurement (i.e., bid, proposal, or qualifications statement, as applicable).

42. SOVEREIGN IMMUNITY

The County specifically reserves any claim it may have to sovereign, qualified, or official immunity as a defense to any action arising in conjunction with this contract.

43. CONTROLLING LAW AND VENUE

Bidder acknowledges and agrees that the contract is and shall be governed and construed by the laws of the State of Texas and that venue shall lie exclusively in a court of competent jurisdiction in Galveston County, Texas.

44. MERGERS, ACQUISITIONS

The Bidder shall be required to notify the County of any potential for merger or acquisition of which there is knowledge at the time that a bid is submitted.

If subsequent to the award of any contract resulting from this Invitation to Bid the Bidder shall merge or be acquired by another firm, the following documents must be submitted to the County:

- A. Corporate resolutions prepared by the awarded Bidder and the new entity ratifying acceptance of the original contract, terms, conditions and prices;
- B. New Bidder's Federal Identification Number (FEIN) and;
- C. New Bidder's proposed operating plans.

Moreover, Bidder is required to provide the County with notice of any anticipated merger or acquisition as soon as Bidder has actual knowledge of the anticipated merger or acquisition. The New Bidder's proposed plan of operation must be submitted prior to merger to allow time for submission of such plan to the Commissioners' Court for its approval.

45. DELAYS

The County reserves the right to delay the scheduled commencement date of the contract if it is to the advantage of the County. There shall be no additional costs attributed to these delays should any occur. Bidder agrees it will make no claims for damages, for damages for lost revenues, for damages caused by breach of contract with third parties, or any

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other claim by Bidder attributed to these delays, should any occur. In addition, Bidder agrees that any contract it enters into with any third party in anticipation of the commencement of the contract will contain a statement that the third party will similarly make no claim for damages based on delay of the scheduled commencement date of the contract.

46. ACCURACY OF DATA

Information and data provided through this Invitation to Bid are believed to be reasonably accurate.

47. SUBCONTRACTING/ASSIGNMENT

Bidder shall not assign, sell, or otherwise transfer its contract in whole or in part without prior written permission of the County acting by and through its Commissioners' Court. Such consent, if granted, shall not relieve the Bidder of any of its responsibilities under this contract.

48. INDEPENDENT CONTRACTOR

Bidder expressly acknowledges that it is an independent contractor. Nothing in this agreement is intended nor shall be construed to create an agency relationship, an employer/employee relationship, a joint venture relationship, or any other relationship allowing County to exercise control or direction over the manner or method by which Bidder or its subcontractors perform in providing the requirements stated in the Invitation to Bid.

49. MONITORING PERFORMANCE

The County shall have the unfettered right to monitor and audit the Bidder's work in every respect. In this regard, the Bidder shall provide its full cooperation and insure the cooperation of its employees, agents, assigns, and subcontractors. Further, the Bidder shall make available for inspection and/or copying when requested, original data, records, and accounts relating to the Bidder's work and performance under this contract. In the event any such material is not held by the Bidder in its original form, a true copy shall be provided.

50. SUBJECT TO APPROPRIATION OF FUNDS

State law prohibits the obligation and expenditure of public funds beyond the fiscal year for which a budget has been approved by the Commissioners' Court. Galveston County anticipates this to be an integral part of future budgets to be approved during the periods of this contract, except for unanticipated needs or events which may prevent such payments against this contract. However, Galveston County cannot guarantee the availability of funds, and enters into this contract only to the extent such funds are made available through appropriation (allocation) by the Commissioners' Court. This contract shall not be construed as creating any debt on behalf of the County of Galveston in violation of TEX. CONST. art. XI, § 7, and it is understood that all obligations of Galveston County are subject to the availability of funds.

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51. CONTRACTS SUBJECT TO GRANT FUNDING

Notwithstanding the foregoing, if the contract to be awarded by this procurement is funded with Federal or State grant funds, the bidder acknowledges that the obligations of the County under the contract are contingent upon the continued availability of grant funding to meet the County's obligations. If the grant(s) to the County is reduced, de-obligated, or otherwise discontinued or terminated, Contractor agrees that the County may immediately terminate the contract without penalty or any liability whatsoever on the part of the County, the State, or the Federal awarding agency.

52. PROCUREMENT ETHICS

Galveston County is committed to the highest ethical standards. Therefore, it is a serious breach of the public trust to subvert the public purchasing process by directing purchases to certain favored vendors, or to tamper with the competitive bidding process, whether it's done for kickbacks, friendship or any other reason. Since misuse of the purchasing power of a local government carries criminal penalties, and many such misuses are from a lack of clear guidelines about what constitutes an abuse of office, the Code of Ethics outlined below must be strictly followed.

Galveston County also requires ethical conduct from those who do business with the County.

CODE OF ETHICS – Statement of Purchasing Policy:

Public employment is a public trust. It is the policy of Galveston County to promote and balance the objective of protecting the County's integrity and the objective of facilitating the recruitment and retention of personnel needed by Galveston County. Such policy is implemented by prescribing essential standards of ethical conduct without creating unnecessary obstacles to entering public office.

Public employees must discharge their duties impartially so as to assure fair competitive access to governmental procurement by responsible contractors. Moreover, they should conduct themselves in such a manner as to foster public confidence in the integrity of the Galveston County procurement organization.

To achieve the purpose of this Article, it is essential that those doing business with Galveston County also observe the ethical standards prescribed herein.

General Ethical Standards:

It shall be a breach of ethics to attempt to realize personal gain through public employment with Galveston County by any conduct inconsistent with the proper discharge of the employee's duties.

It shall be a breach of ethics to attempt to influence any public employee of Galveston County to breach the standards of ethical conduct set forth in this code.

It shall be a breach of ethics for any employee of Galveston County to participate directly or indirectly in a procurement when the employee knows that:

- The employee or any member of the employee's immediate family, has a financial interest pertaining to the procurement;
- A business or organization in which the employee or any member of the employee's immediate family, has a financial interest pertaining to the procurement; or

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- Any other person, business, or organization with which the employee or any member of the employee's immediate family is negotiating or has an arrangement concerning prospective employment is involved in the procurement.

Gratuities:

It shall be a breach of ethics for any person to offer, give, or agree to give any employee or former employee of Galveston County, or for any employee or former employee of Galveston County to solicit, demand, accept or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, preparation of any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling, determination, claim or controversy, or other particular matter, pertaining to any program requirement or a contract or subcontract, or to any solicitation or bid pending before this government.

Kickbacks:

It shall be a breach of ethics for any payment, gratuity or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor for any contract for Galveston County, or to any person associated therewith, as an inducement for the award of a contract, subcontract or order.

Contract Clause:

The prohibition against gratuities and kickbacks prescribed above shall be conspicuously set forth in every contract and solicitation by Galveston County.

Confidential Information:

It shall be a breach of ethics for any employee or former employee of Galveston County to knowingly use confidential information for actual or anticipated personal gain, or for the actual or anticipated gain of any other person.

Prohibition against Contingent Fees:

It shall be a breach of ethical standards for a person to be retained, or to retain a person, to solicit or secure a Galveston County contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, except for retention of bona fide employees or bona fide established commercial selling agencies for the purpose of securing business. Failure to abide by this section constitutes a breach of ethical standards.

Representation:

Bidder represents and warrants, by signing and submitting its bid, that it has not retained anyone in violation of this section prohibiting contingent fees.

Contract Clause:

The representation prescribed above shall be conspicuously set forth in every contract and solicitation thereof.

53. NON-COLLUSION AFFIDAVIT

Bidder certifies, by signing and submitting a bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the contractor has not directly or indirectly induced or solicited another contractor to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any contractor or anyone else to put in a sham bid or that anyone shall refrain from bidding; that the contractor has not in any manner, directly or indirectly, sought by agreement, communications, or conference with anyone to fix the bid price of the contractor of any other bidder, or to fix any overhead, profit or cost element of the bid price, or that of any other

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contractor, or to secure any advantage against the public body awarding the contract or anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the contractor has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any cooperation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

A blank Non-Collusion Affidavit is included with this Bid packet. Bidder must enclose a truthful and fully executed original Non-Collusion Affidavit with the submission of its bid. This is a mandatory requirement of this Invitation to Bid. Failure to include the truthfully and fully executed Non-Collusion Affidavit in the submission of its Bid shall be considered non-compliance with the requirements of this Invitation to Bid by the Bidder and grounds for the rejection of Bidder's submission.

No negotiations, decisions, or actions shall be initiated by any company as a result of any verbal discussion with any County employee prior to the opening of responses to this Invitation to Bid.

No officer or employee of the County of Galveston, and no other public or elected official, or employee, who may exercise any function or responsibilities in the review or approval of this undertaking shall have any personal or financial interest, direct or indirect, in any contract or negotiation process thereof. The above compliance request will be part of all County of Galveston contracts for this service.

54. CERTIFICATION REGARDING LOBBYING

Bidder certifies that:

- a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the bidder, to any person for influencing or attempting to influence a department or employee of an agency, a member of Congress, or an employee of a member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan or cooperative agreement.
- b. If any funds other than federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence a department or employee of any agency, a member of Congress, a department or employee of congress, or an employee of a member of Congress in connection with this federal contract, grant, loan, or cooperative agreement, the bidder shall complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying", in accordance with its instructions.
- c. Bidder shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

The truthful and fully completed and executed original of the Certification Regarding Lobbying (included with bid packet) must be included with the submission of Bidder's Bid and is a mandatory requirement of this Invitation to Bid. Bidder's failure to include the fully completed and executed or original of this Certification shall be considered non-compliant with the requirements of this Invitation to Bid and grounds for the rejection of the Bidder's Bid. Submission of the certification is a prerequisite for making or entering into a contract with Bidder and is imposed by

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Section 1352, Title 31, United States Code. Further, any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

55. NON-DISCRIMINATION

- a. **Equal Employment Opportunity:** Bidder will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, sex, disability, genetic information or veteran status. Bidder will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, national origin, sex, disability, genetic information or veteran status. Such action shall include, but not be limited to, the following: employment; upgrading; demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Bidder agrees to post in conspicuous places, available to employees and applicants for employment, notices of employment.

Bidder will, in all solicitation or advertisements for employees placed by or on behalf of Bidder, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, sex, disability, genetic information, or veteran status.

Bidder will cause the foregoing provisions to be inserted in all subcontracts for any work covered by this Agreement so that such provisions will be binding upon each subcontractor, provided that the foregoing provisions shall not apply to contracts or subcontracts for standard commercial supplies or raw materials.

Bidder will include the provisions herein in every subcontract or purchase order unless exempted.

- b. **Drug Free Work Place Act:** Bidder shall comply with all applicable requirements of the Drug-Free Workplace Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. § 8102, et seq.) and implementing regulations thereunder.
- c. **Americans with Disabilities Act:** Bidder shall comply with all applicable provisions of the Americans with Disabilities Act of 1990 (Public Law 101-136) and implementing regulations thereunder.
- d. **OSHA Regulations:** Bidder agrees to maintain and to display any applicable materials for its employees in accordance with OSHA regulations.
- e. **Compliance with Immigration Laws and Use of E-Verify:** Bidder agrees to comply with all requirements of the U.S. Immigration Reform and Control Act of 1986, as amended, and any implementing regulations thereto. Bidder further agrees to utilize the E-Verify system through the Department of Homeland Security on its employees. Bidder shall not employ unauthorized aliens, and shall not assign services to be performed to any supplier or subcontractor who are unauthorized aliens. If any personnel performing any services hereunder are discovered to be an unauthorized alien, then Bidder will immediately remove such personnel from performing services hereunder and shall replace such personnel with personnel who are not unauthorized alien(s).
- f. **State and Federal Law Compliance:** Bidder agrees to comply with all other State and Federal laws and regulations applicable to the provision of services under this contract.

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56. RECORD RETENTION AND RIGHT TO AUDIT

Bidder shall keep and maintain all records associated with this contract for a minimum of five (5) years from the close of the contract or as required by Federal or State law or regulation, whichever period is longer. If awarded this contract, Bidder shall allow the County reasonable access to the records in Bidder's possession, custody, or control that the County deems necessary to assist it in auditing the services, costs, and payments provided hereunder. If this contract involves the use of Federal or State funds, then Bidder shall also allow reasonable access to representatives of the Office of Inspector General, the General Accounting Office, and the other Federal and/or State agencies overseeing the funds that such entities deem necessary to facilitate review by such agencies and Bidder shall maintain fiscal records and supporting documentation for all expenditures in a manner that conforms with OMB Circular A-87 (relocated to 2 C.F.R. Part 225) and this contract.

57. TITLE VI ASSURANCES/TxDOT

The County is subject to Title VI of the Civil Rights Act of 1964 and the Federal and State laws and regulations of the United States Department of Transportation and Texas Department of Transportation (TxDOT). Pursuant to these requirements, the County must have its contractors provide required assurances on compliance with non-discrimination by itself and its subcontractors. The Title VI Assurances within this Subsection are not exhaustive – whenever any Federal, State, or Local requirement requires additional clauses, this list shall not be construed as limiting. Contractor agrees as follows:

- (1) **Compliance with Regulations:** The Contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the Department of Transportation (hereinafter, DOT) Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the Regulations), which are incorporated herein by reference and made a part of this contract.
- (2) **Non-discrimination:** The Contractor, with regard to the work performed by it during the contract, shall not discriminate on the basis of race, color, national origin, religion, sex, age, disability or Veteran status in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.
- (3) **Solicitations for Subcontractors, Including Procurement of Materials and Equipment:** In all solicitations either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurement of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the Contractor of the Contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, national origin, religion, sex, age, disability or Veteran status.
- (4) **Information and Reports:** The Contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information and its facilities as may be determined by the Galveston County or the Texas Department of Transportation to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of the Contractor is in the exclusive possession of another who fails or refuses to furnish this information the Contractor shall so certify to Galveston County or the Texas Department of Transportation as appropriate, and shall set forth what efforts it has made to obtain the information.
- (5) **Sanctions for Non-compliance:** In the event of the Contractor's noncompliance with the nondiscrimination provisions of this contract, Galveston County shall impose such contract sanctions as it or the Texas Department of Transportation may determine to be appropriate, including, but not limited to:

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- (a) withholding of payments to the Contractor under the contract until the Contractor complies, and/or;
- (b) cancellation, termination, or suspension of the contract, in whole or in part.

(6) Incorporation of Provisions. The Contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurement of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The Contractor shall take such action with respect to any subcontract or procurement as Galveston County or the Texas Department of Transportation may direct as a means of enforcing such provisions including sanctions for non-compliance: Provided, however, that, in the event Contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the Contractor may request Galveston County to enter into such litigation to protect the interests of Galveston County, and, in addition, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

58. SECTION 231.006, FAMILY CODE/DELINQUENT CHILD SUPPORT

Pursuant to Title 5, Section 231.006 of the Texas Family Code, as applicable, Bidder certifies that it, including all of its principals, is/are current in child support payments and therefore, that it is eligible to receive payments from State funds under a contract for property, materials, or services. Bidder acknowledges and agrees that if it is awarded this contract, then the ensuing agreement may be terminated and payment withheld if this certification is inaccurate. Finally, by the submission of its bid, the Bidder certifies that it has included the names and social security numbers of each person with at least 25% ownership interest in Bidder within its response to the Invitation to Bid and that all such persons are current in child support payments.

59. ANTITRUST

Pursuant to 15 U.S.C. § 1, et seq., and Texas Business and Commerce Code, Chapter 15, Contractor, by the submission of its bid, certifies that neither Contractor nor any natural person, proprietorship, firm, corporation, partnership, association, or institution represented by Contractor or anyone acting for such natural person, proprietorship, firm, corporation, partnership, association, or institution has violated any Federal or State antitrust laws or communicated the nature of the offer, directly or indirectly, to any competitor or other person engaged in a similar line of business.

60. LABOR STANDARDS

On contracts funded under a federal grant: Bidder acknowledges that the contract to be awarded pursuant to this solicitation is on a grant program funded with Federal funds. Bidder shall comply with the requirements of 29 CFR Part 5 and Part 30 and shall be in conformity with Executive Order 11246, entitled "Equal Employment Opportunity", Copeland, "Anti-Kickback" Act (40 U.S.C. 3145, 29 C.F.R. Part 3), the Davis-Bacon and Related Acts (40 U.S.C. 3141-3148, 29 C.F.R. Parts 1,3, and 5), the Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 et seq.), and all other applicable Federal, State, and local laws and regulations pertaining to labor standards, insofar as those acts apply to the performance of this Agreement. Bidder is also responsible for ensuring that all subcontractors comply with the requirements of 29 CFR Part 5 and Part 30 and shall be in conformity with Executive Order 11246, entitled "Equal Employment Opportunity", Copeland "Anti-Kickback" Act, the Davis-Bacon and Related Acts (29 CFR Parts 1, 3 and 5), the Contract Work Hours and Safety Standards Act (40 U.S.C. 3701 et seq.), and all other applicable Federal, State, and local laws and regulations pertaining to labor standards, insofar as those acts apply to the performance of this Agreement.

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61. PROCUREMENT LAWS

- a. Bidder shall comply with all applicable local, State, and Federal procurement laws, rules, and regulations.
- b. If this contract is made pursuant to a federal award, then Contractor acknowledges that the contract is subject, without limitation, to applicable provisions within 2 C.F.R. Part 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards. Contractor shall comply with applicable provisions within 2 C.F.R., Sections 200.319 through 200.326, including but not limited to the following:
 - 1.) **Equal Employment Opportunity**, 41 C.F.R. Part 60-1.4(b) (applicable to federally assisted construction contracts).
 - (a) During the performance of this contract, the contractor agrees as follows:
 - (1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national original, disability, or veteran status. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, national original, disability or veteran status. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
 - (2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national original, disability, or veteran status.
 - (3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
 - (4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and by rules, regulations, and relevant orders of the Secretary of Labor.
 - (5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to contractor's books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
 - (6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
 - (7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of

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September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

- 2.) **Small and minority business, women’s business enterprises, and labor surplus area firms (2 C.F.R. § 200.321).** The County is required to take affirmative steps to assure that minority businesses, women’s business enterprises, and labor surplus area firms are used when possible. This includes requiring the prime contractor, if subcontracts are to be let in the performance of this contract, to itself take affirmative steps in letting the subcontract. Accordingly, if subcontracts are to be let in the performance of this contract, the contractor must take affirmative steps in the letting of the subcontract(s), which must include:
- (a) placing qualified small and minority businesses and women’s business enterprises on solicitation lists;
 - (b) assuring that small and minority businesses, and women’s business enterprises are solicited whenever they are potential sources;
 - (c) dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women’s business enterprises; and
 - (d) using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

In accordance with FEMA procurement guidance:

A small business is a business that is independently owned and operated, not dominant in the field of operation in which it is bidding on Galveston County contracts, and qualified as a small business under the Small Business Administration criteria and size standards at 13 C.F.R. Part 121.

A women’s business enterprise is a business enterprise that is: (a) at least 51 percent owned by one or more women or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women; and (b) whose management and daily operations are controlled by one or more women.

A minority business is a business that is (a) at least 51 percent owned by one or more minority group members or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority group members; and (b) whose management and daily operations are controlled by one or more minority group members.

- 3.) **Davis-Bacon Act as amended (40 U.S.C. 3141-3148).** When required by Federal program legislation, all prime construction contracts in excess of \$2,000 must include a provision for compliance with the Davis-Bacon Act as supplemented by the Department of Labor regulations (29 C.F.R. Part 5, “Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction”). In accordance with the statute, contractor must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity (the County) must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be condition upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contract must also include a provision for compliance with the Copeland Anti-Kickback Act (40 U.S.C. § 3145) as supplemented by the Department of Labor regulations (29 C.F.R. Part 3, “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”).

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- 4.) **Compliance with the Copeland “Anti-Kickback” Act.** Contractor is prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which the person is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. “Whoever, by force, intimidation, or threat of procuring dismissal from employment, or by any other manner whatsoever induces any person employed in the construction, prosecution, completion or repair of any public building, public work, or building or work financed in whole or in part by loans or grants from the United States, to give up any part of the compensation to which he is entitled under his contract of employment, shall be fined under this title [Title 18, U.S.C.] or imprisoned not more than five years, or both.” 18 U.S.C. § 874.
- (a) Contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. Part 3 as may be applicable, which are incorporated by reference into this contract.
 - (b) The contractor or subcontractor shall insert in any subcontracts the clause above and such other clauses as the Federal awarding agency may be appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
 - (c) Breach. A breach of the contract clause above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29C.F.R. § 5.12.
- 5.) **Contract Work Hours and Safety Standards Act.**
- (a) Where applicable, all contracts awarded by the County in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704, as supplemented by the Department of Labor regulations at 29 C.F.R. Part 5. Under 40 U.S.C. 3702 of the Contract Work Hours and Safety Standards Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.S. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchase of supplies or material or articles ordinarily available on the open market, or contractors for transportation or transmission of intelligence.
 - (b) Compliance with the Contract Work Hours and Safety Standards Act.
 - (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
 - (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this subsection the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this subsection, in the sum of \$10 for each calendar day on which such individual was

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required or permitted to work in excess of the standard work week of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this subsection.

- (3) Withholding for unpaid wages and liquidated damages. The awarding Federal agency, State agency, or the County shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this subsection.
- (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this subsection and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this subsection.

6.) Rights to Inventions Made Under a Contractor Agreement.

- (a) If the Federal award meets the definition of “funding agreement” under 37 C.F.R. § 401.2(a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under the “funding agreement,” the recipient or subrecipient must comply with the requirements of 37 C.F.R. Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.
- (b) Stafford Act Disaster Grants. This requirement does not apply to Public Assistance, Hazard Mitigation Grant Program, Crisis Counseling Assistance and Training Grant program, Disaster Case Management Grant Program, and Federal Assistance to Individuals and Households – Other Needs Assistance Grant Program, as FEMA awards under these programs do not meet the definition of “funding agreement.”
- (c) The regulations and 37 C.F.R. § 401.2(a) currently defines “funding agreement” as any contract, grant, or cooperative agreement entered into between any Federal agency, other than the Tennessee Valley Authority, and any contractor for the performance of experimental, developmental, or research work funded in whole or in part by the Federal government. This term also includes any assignment, substitution of parties, or subcontract of any type entered into for the performance of experimental, developmental, or research work under a funding agreement as defined in the first sentence of this paragraph.

7.) Clean Air Act (42 U.S.C. §§ 7401 – 7671q) and the Federal Water Pollution Control Act 933 U.S.C. §§ 1251-1387), as amended.

- (a) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401, et seq., and agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Contract Act, as amended, 33 U.S. C. § 1251, et seq.
- (b) The contractor agrees to report each violation of the Clean Air Act and/or the Federal Water Pollution Control Act to the Federal awarding agency, the State agency administering the grant, and the Regional Office of the Environmental Protection Agency (EPA) and understands and agrees that the Federal awarding agency, the State

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agency, and the EPA will, in turn, report each violation as required to assure notification to Galveston County, the Federal Emergency Management Agency, and the appropriate EPA Regional Office.

- 8.) **Debarment and Suspension (Executive Orders 12549 and 12689).** A contract award must not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. Part 180 that implement Executive Orders 12549 and 12689. The Contractor is required to verify that none of the contractor, its principals (defined at 2 C.F.R. § 180.995), or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).

Contractor must comply with 2 C.F.R. Part 180, Subpart C and 2 C.F.R. Part 3000, Subpart C, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into. Bidder agrees to comply with the requirements of 2 C.F.R. Part 180, Subpart C, and 2 C.F.R. Part 3000, Subpart C, while this offer is valid and through the period of any contract that may arise from this offer. The bidder further agrees to include a provision requiring such compliance in its lower tier covered transactions.

9.) **Procurement of Recovered Materials.**

- (a.) A non-Federal entity that is a State agency or agency of a political subdivision of the State and its contractors must comply with Section 6002 of the Solid Waste Disposal Act, Public Law No. 89-272 (1965) (codified as amended by the Resource Conservation and Recovery Act at 42 U.S.C. § 6962).
- (b.) In the performance of this contract, the contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired—
- (1) Competitively within a timeframe providing for compliance with the contract performance schedule;
 - (2) Meeting contract performance requirements; or
 - (3) At a reasonable price.
- (c) Information about this requirement is available at EPA's Comprehensive Procurement Guidelines website, <http://www.epa.gov/cpg/>. The list of EPA-designated items is available at <https://www.epa.gov/cpg/products.htm>.

In the event of any discrepancy between the provisions in this Section 61 of General Provisions and provisions on the same subject elsewhere within this procurement, the most stringent shall control.

62. ENTIRETY OF AGREEMENT AND MODIFICATION

This contract contains the entire agreement between the parties. Any prior agreement, promise, negotiation or representation not expressly set forth in this contract has no force or effect. Any subsequent modification to this contract must be in writing, signed by both parties.

An official representative, employee, or agent of the County does not have the authority to modify or amend this contract except pursuant to specific authority to do so granted by the Galveston County Commissioners' Court.

63. NOTICE

All notices or other communications required or permitted under this contract shall be in writing and shall be deemed to have been duly given if delivered personally in hand, transmitted by facsimile, or mailed certified mail, return receipt requested with proper postage affixed and addressed to the appropriate party at the following address or at

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such other address as may have been previously given in writing to the parties (Bidder shall provide its notice information with its Bid submission). If mailed, the notice shall be deemed delivered when actually received, or if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, duly certified, return receipt requested, with proper postage affixed. If delivered in person, notice shall be deemed delivered when receipted for by, or actually received by, the receiving Party. If transmitted by facsimile, notice shall be deemed delivered when receipt of such transmission is acknowledged.

To the County at:

Hon. Mark Henry,
County Judge of Galveston County
722 Moody (21st Street), Second (2nd) Floor
Galveston, Texas 77550
Fax: (409) 765-2653

With copies to:

Rufus Crowder, CPPO CPPB,
Galveston County Purchasing Agent
722 Moody (21st Street), Fifth (5th) Floor
Galveston, Texas 77550
Fax: (409) 621-7997

Robert Boemer, Director,
Galveston County Legal Department
722 Moody (21st Street), Fifth (5th) Floor
Galveston, Texas 77550
Fax: (409) 770-5560

To the Contractor at:

(Bidder to provide its contact name, address, and facsimile number for notice under the contract.)

64. USE OF DHS SEAL, LOGO, AND FLAGS PROHIBITED WITHOUT PRIOR APPROVAL

Contractor must obtain permission from the U.S. Department of Homeland Security financial assistance office (DHS FAO) **prior** to using DHS seals(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials, including use of the United States Coast Guard seal, logo, crests or reproductions of flags or likenesses of Coast Guard Officials.

65. FEDERAL GOVERNMENT NOT A PARTY

Contractor acknowledges that the Federal Government is not a party to the contract and is not subject to any obligations or liabilities to Galveston County, contractor, or any other party pertaining to any matter resulting from the contract.

66. PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS OR RELATED ACTS

In contracts funded through Federal grants, Contractor acknowledges that 31 U.S.C. Chapter 38, Administrative Remedies for False Claims and Statements (31 U.S.C. § 3801, et seq.) and the implementing regulations thereunder, 49 C.F.R. Part 79, apply to Contractors actions pertaining to the contract.

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End of General Provision Section

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The Special Provisions section of this Invitation to Bid solicitation and the exhibits attached herein are made a part of the entire agreement between the parties with respect to the subject matter of the Invitation to Bid and Resultant Contract Agreement, and supersede the General Provisions, any prior negotiations, agreements and understanding with respect thereto.

A. PURPOSE

Work includes construction of a second floor mezzanine, build-out of the MCC room, HVAC, automatic emergency power transfer switch, conduits for the MCC and emergency power, associated appurtenances, and work associated with construction.

B. DEFINITIONS (As mentioned in FAR Subpart 52.2—Text of Provisions and Clauses)

52.202-1 Definitions.

Definitions (Nov 2013)

When a solicitation provision or contract clause uses a word or term that is defined in the Federal Acquisition Regulation (FAR), the word or term has the same meaning as the definition in FAR [2.101](#) in effect at the time the solicitation was issued, unless—

- (a) The solicitation, or amended solicitation, provides a different definition;
- (b) The contracting parties agree to a different definition;
- (c) The part, subpart, or section of the FAR where the provision or clause is prescribed provides a different meaning; or
- (d) The word or term is defined in FAR [Part 31](#), for use in the cost principles and procedures

C. BID SURETY

A Bid surety/bond is a requirement of this solicitation.

D. PERFORMANCE AND PAYMENT BONDS

Performance and Payment Bonds are a requirement of this solicitation.

E. BEST AND FINAL OFFERS (BAFO)

The Best and Final Offer process is not applicable to this solicitation.

F. PROCUREMENT TIMELINE

A timeline for this Bid and initial process is included below. Galveston County reserves the right to change these dates and will notify Bidders of any changes:

Advertise Bid (first date of publication)	Wednesday, June 13 2018
Advertise Bid (second date of publication)	Wednesday, June 20, 2018
Pre-Bid Conference	Wednesday, June 27, 2018 at 10:00 A.M.
Deadline for Questions & Inquiries	Monday, July 2, 2018 @ 5:00 P.M.
Bids due from public/RFP Opening	Tuesday, July 17, 2018 @ 2:00 P.M.

G. PRE-BID CONFERENCE

A non-mandatory pre-Bid conference will be held on Wednesday, June 27, 2018 at 10:0 a.m. at the Galveston County Courthouse, Purchasing Department, 722 Moody (21st Street), Fifth (5th) Floor, Galveston, Texas 77550.

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H. PERSONNEL TO CONTACT

Bidders desiring an explanation or interpretation relative to this solicitation must request it in writing. Oral explanations or instructions will not be binding. Any information given to a Proposer, which in the opinion of the County affects all responders or would be prejudicial to other Bidders if not communicated, shall be furnished to all Bidders as an addendum to the solicitation. Bidders **must** direct all inquiries to the following:

**Rufus G. Crowder, CPPO CPPB
Purchasing Agent
722 21st Street (Moody)
Galveston, Texas 77550
e-mail: rufus.crowder@co.galveston.tx.us**

Bidders must e-mail their requests (with the subject line “**San Leon MUD Motor Control Center – RFP # B181051– Questions**”) for additional information and/or clarification to the address listed above. The request must include the Proposer’s name and the RFP number and title. ***Any request for additional information or clarification must be received in writing no later than seven (7) calendar days prior to the Bid due date.*** Late requests or those not delivered to the proper address may not receive a reply. Bidders shall not attempt to contact the County by any other means. The Purchasing Agent’s Office shall post the answers to the County website from the procurement web page and via addendum.

The County will issue responses to inquiries and any other corrections or amendments, it deems necessary, in the form of a written addendum, issued prior to the Bid Submission Date. The County, at its sole discretion, may not issue a response to a RFI submittal. Bidders should not rely on any oral or written representations, statements, or explanations, other than those made in this RFP or in any written addendum to this RFP. Where there appears to be conflict between the RFP and any issued addenda, the last addendum issued will prevail. Addenda will be posted and made available on the County’s procurement web page. It is the Proposer's sole responsibility to ensure receipt of all addenda prior to submitting its Bid. All Bidders should check the County’s procurement web page for all addenda prior to submitting a response. The County’s procurement web page is located at www.galvestoncountytexas.gov/pu/Pages/default.aspx, and current solicitations are at www.galvestoncountytexas.gov/pu/Pages/OpenSolicitations.aspx.

The Bidder must acknowledge the receipt of all addenda on the forms provided. In the event a Bidder fails to acknowledge receipt of such addenda, the County may, at its sole discretion, determine that such failure to acknowledge any or all addenda does not materially affect the Bid and waive the acknowledgement of one or more addenda.

Bidders who submit inquiries *after* the deadline date for receipt of questions indicated on the Procurement Timeline, risk that its response in the procurement will not be responsive or competitive because the County is not able to respond before the Bid receipt date or in sufficient time for the Proposer to prepare a responsive or competitive submittal.

All questions and responses as posted on the County website pertaining to this Bid are considered an addendum to, and part of, this Bid. Each Bidder shall be responsible to monitor the County website for new or revised bid information. The County shall not be bound by any verbal information nor shall it be bound by any written information that is not either contained within the bid or formally issued as an addendum by the Purchasing Agent’s Office.

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I. PROGRAM ADMINISTRATION & CONTRACT MANAGEMENT

The Program Administrator/Contract Manager that will manage the work to be performed under the resultant contract for the purpose of this bid is:

**Michael Shannon
Galveston County Engineer
722 21st Street (Moody)
Galveston, TX 77550
Office: (409) 770-5453**

e-mail: michael.shannon@co.galveston.tx.us

J. TYPE OF CONTRACT

It is the intent of this solicitation to enter into a contract that meets federal guidelines. It is imperative that all responders seeking a contract under this Bid solicitation effort must familiarize and adhere to the procurement standards as referenced in 2 C.F.R. Part 200, Sections 200.317-200.326, and Appendix II 2 C.F.R. Part 200. Sections 200.317-200.326 and Appendix II are attached hereto as **Exhibit A**.

The resultant contract consists of the following documents: Invitation to Bid, General Provisions, Special Provisions, General Terms and Conditions (including specifications, drawings, and addenda), Proposer's Bid, Bid Sheets, contract award, and any other documents referenced herein or attached hereto for the work. Collectively these documents may also be referred to as the Plans and Specifications.

In an effort to satisfy cost reasonableness responsibilities at the time of each extension period, the County of Galveston reserves the right to obtain additional quotes and current pricing information from the successful contractor and other contractors to perform the work as stated per the specification listed herein and in the resultant. The solicited results may be used by the County to determine if the contract extensions will be considered or other service options be utilized.

K. COLLATERAL CONTRACT

The County reserves the right to provide by separate contract or otherwise, in such manner as not to delay its programs or damage said Contractor, all labor and material essential to the completion of the work that is not included in this contract.

Award prices include all royalties and costs arising from patents, trademarks, and copyrights in any way involved in the work. Whenever the Awardee is required or desires to use any design, device, material or process covered by letters of patent or copyright, the Awardee shall indemnify and save harmless the County, its officers, agents and employees from any and all claims for infringement by reason of the use of any such patented design, tool, material, equipment, or process, to be performed under the contract, and shall indemnify the County its officers, agents, and employees for any costs, expenses and damages which may be incurred by reason of any infringement at any time during the prosecution or after the completion of the work.

L. LABOR

Contractor is encouraged to use local labor, but not at the expense of poor workmanship and higher cost. Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. Contractor agrees to post in a conspicuous place a notice setting forth provisions of this non-discrimination clause.

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M. INSURANCE

Proposer must submit, with its response, a current certificate of insurance evidencing coverage in the amounts specified below or greater. In lieu of submitting a certificate of insurance, Respondents may submit a notarized statement from an insurance company authorized to conduct business in the State of Texas guaranteeing that Respondent has such insurance. Provided however, that successful Respondent(s) shall be required to provide a current certificate of insurance to the Galveston County Purchasing Agent's Office before Respondent commences any work hereunder. **Insurance shall be placed with insurers having an A.M. Best's rating of no less than A.** Such insurance must be issued by a casualty company authorized to do business in the State of Texas, and in standard form approved by the Board of Insurance Commissioners of the State of Texas, with coverage provisions insuring the public from loss or damage that may arise to any person or property by reason of services rendered by Contractor.

Galveston County shall be listed as an additional insured on each policy and all certificates of insurance and Contractor shall provide Galveston County with no less than thirty (30) calendar days prior notice of any changes to the policy during the contractual period.

Certificates of Insurance, fully executed by a licensed representative of the insurance company written or countersigned by an authorized Texas state agency, shall be filed with the County Purchasing Agent within ten (10) calendar days of the execution of this Agreement as written proof of such insurance and further provided that Contractor shall not commence work under this Agreement until Contractor has obtained all insurance required herein, provided written proof as required herein, and received written notice to proceed issued from the County Purchasing Agent. **Failure to provide such evidence of insurance within the ten (10) calendar day period shall constitute an event of default.**

Workers' Compensation Insurance. Respondent shall carry in full force Workers' Compensation Insurance Policy(ies), if there is more than one employee, for all its employees, including but not limited to full time, part time, and emergency employees employed by the Contractor.

Commercial General Liability. Respondent shall carry in full force commercial general liability insurance with a limit of not less than \$1,000,000 each occurrence and \$2,000,000 in the aggregate. The Policy shall, minimally, cover liability for bodily injury, personal injury, and property damage.

Business Automobile Liability. Respondent shall carry in full force business automobile liability coverage with a combined bodily injury/property damage limit of not less than \$1,000,000 each accident. The policy shall cover liability arising from the operation of licensed vehicles by policyholder.

Professional Liability. Respondent shall carry in full force professional liability insurance with limits of not less than \$1,000,000.00.

Subrogation Waiver. Contractor and Contractor's insurance carrier shall waive any and all rights to subrogation against Galveston County in regard to any suit or claim arising out of personal injury or property damage resulting from Contractor's performance under this Agreement.

End of Special Provisions Section

**EXHIBIT A
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PROCUREMENT STANDARDS

**2 C.F.R. §§ 200.317 – 200.326 &
2 C.F.R. PART 200, APPENDIX II**

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PROCUREMENT STANDARDS

**2 C.F.R. §§ 200.317 – 200.326 &
2 C.F.R. PART 200, APPENDIX II**

2 C.F.R. § 200.317. Procurements by states.

When procuring property and services under a Federal award, a state must follow the same policies and procedures it uses for procurements from its non-Federal funds. The state will comply with §200.322 Procurement of recovered materials and ensure that every purchase order or other contract includes any clauses required by section §200.326 Contract provisions. All other non-Federal entities, including subrecipients of a state, will follow §§ 200.318 General procurement standards through 200.326 Contract provisions.

69 FR 26280, May 11, 2004; 78 FR 78608, Dec. 26, 2013

2 C.F.R. § 200.318. General procurement standards.

(a) The non-Federal entity must use its own documented procurement procedures which reflect applicable State, local and tribal laws and regulations, provided that the procurements conform to applicable Federal law and the standards identified in this part.

(b) Non-Federal entities must maintain oversight to ensure that contractors perform in accordance with the terms, conditions, and specifications of their contracts or purchase orders.

(c)

(1) The non-Federal entity must maintain written standards of conduct covering conflicts of interest and governing the actions of its employees engaged in the selection, award and administration of contracts. No employee, officer, or agent may participate in the selection, award, or administration of a contract supported by a Federal award if he or she has a real or apparent conflict of interest. Such a conflict of interest would arise when the employee, officer, or agent, any member of his or her immediate family, his or her partner, or an organization which employs or is about to employ any of the parties indicated herein, has a financial or other interest in or a tangible personal benefit from a firm considered for a contract. The officers, employees, and agents of the non-Federal entity may neither solicit nor accept gratuities, favors, or anything of monetary value from contractors or parties to subcontracts. However, non-Federal entities may set standards for situations in which the financial interest is not substantial or the gift is an unsolicited item of nominal value. The standards of conduct must provide for disciplinary actions to be applied for violations of such standards by officers, employees, or agents of the non-Federal entity.

(2) If the non-Federal entity has a parent, affiliate, or subsidiary organization that is not a state, local government, or Indian tribe, the non-Federal entity must also maintain written standards of conduct covering organizational conflicts of interest. Organizational conflicts of interest means that because of

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relationships with a parent company, affiliate, or subsidiary organization, the non-Federal entity is unable or appears to be unable to be impartial in conducting a procurement action involving a related organization.

- (d) The non-Federal entity's procedures must avoid acquisition of unnecessary or duplicative items. Consideration should be given to consolidating or breaking out procurements to obtain a more economical purchase. Where appropriate, an analysis will be made of lease versus purchase alternatives, and any other appropriate analysis to determine the most economical approach.
- (e) To foster greater economy and efficiency, and in accordance with efforts to promote cost-effective use of shared services across the Federal Government, the non-Federal entity is encouraged to enter into state and local intergovernmental agreements or inter-entity agreements where appropriate for procurement or use of common or shared goods and services.
- (f) The non-Federal entity is encouraged to use Federal excess and surplus property in lieu of purchasing new equipment and property whenever such use is feasible and reduces project costs.
- (g) The non-Federal entity is encouraged to use value engineering clauses in contracts for construction projects of sufficient size to offer reasonable opportunities for cost reductions. Value engineering is a systematic and creative analysis of each contract item or task to ensure that its essential function is provided at the overall lower cost.
- (h) The non-Federal entity must award contracts only to responsible contractors possessing the ability to perform successfully under the terms and conditions of a proposed procurement. Consideration will be given to such matters as contractor integrity, compliance with public policy, record of past performance, and financial and technical resources. See also § 200.213 Suspension and debarment.
- (i) The non-Federal entity must maintain records sufficient to detail the history of procurement. These records will include, but are not necessarily limited to the following: rationale for the method of procurement, selection of contract type, contractor selection or rejection, and the basis for the contract price.
- (j)
- (1) The non-Federal entity may use a time and materials type contract only after a determination that no other contract is suitable and if the contract includes a ceiling price that the contractor exceeds at its own risk. Time and materials type contract means a contract whose cost to a non-Federal entity is the sum of:
- (i) The actual cost of materials; and
 - (ii) Direct labor hours charged at fixed hourly rates that reflect wages, general and administrative expenses, and profit.
- (2) Since this formula generates an open-ended contract price, a time-and-materials contract provides no positive profit incentive to the contractor for cost control or labor efficiency. Therefore, each contract must set a ceiling price that the contractor exceeds at its own risk. Further, the non-Federal entity awarding such a contract must assert a high degree of oversight in order to obtain reasonable assurance that the contractor is using efficient methods and effective cost controls.

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(k) The non-Federal entity alone must be responsible, in accordance with good administrative practice and sound business judgment, for the settlement of all contractual and administrative issues arising out of procurements. These issues include, but are not limited to, source evaluation, protests, disputes, and claims. These standards do not relieve the non-Federal entity of any contractual responsibilities under its contracts. The Federal awarding agency will not substitute its judgment for that of the non-Federal entity unless the matter is primarily a Federal concern. Violations of law will be referred to the local, state, or Federal authority having proper jurisdiction.

78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75885, Dec. 19, 2014; 80 FR 43309, July 22, 2015; 80 FR 45395, July 30, 2015

2 C.F.R. § 200.319. Competition.

(a) All procurement transactions must be conducted in a manner providing full and open competition consistent with the standards of this section. In order to ensure objective contractor performance and eliminate unfair competitive advantage, contractors that develop or draft specifications, requirements, statements of work, or invitations for bids or requests for proposals must be excluded from competing for such procurements. Some of the situations considered to be restrictive of competition include but are not limited to:

- (1) Placing unreasonable requirements on firms in order for them to qualify to do business;
- (2) Requiring unnecessary experience and excessive bonding;
- (3) Noncompetitive pricing practices between firms or between affiliated companies;
- (4) Noncompetitive contracts to consultants that are on retainer contracts;
- (5) Organizational conflicts of interest;
- (6) Specifying only a “brand name” product instead of allowing “an equal” product to be offered and describing the performance or other relevant requirements of the procurement; and
- (7) Any arbitrary action in the procurement process.

(b) The non-Federal entity must conduct procurements in a manner that prohibits the use of statutorily or administratively imposed state, local, or tribal geographical preferences in the evaluation of bids or proposals, except in those cases where applicable Federal statutes expressly mandate or encourage geographic preference. Nothing in this section preempts state licensing laws. When contracting for architectural and engineering (A/E) services, geographic location may be a selection criterion provided its application leaves an appropriate number of qualified firms, given the nature and size of the project, to compete for the contract.

(c) The non-Federal entity must have written procedures for procurement transactions. These procedures must ensure that all solicitations:

- (1) Incorporate a clear and accurate description of the technical requirements for the material, product, or service to be procured. Such description must not, in competitive procurements, contain features which unduly

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restrict competition. The description may include a statement of the qualitative nature of the material, product or service to be procured and, when necessary, must set forth those minimum essential characteristics and standards to which it must conform if it is to satisfy its intended use. Detailed product specifications should be avoided if at all possible. When it is impractical or uneconomical to make a clear and accurate description of the technical requirements, a "brand name or equivalent" description may be used as a means to define the performance or other salient requirements of procurement. The specific features of the named brand which must be met by offers must be clearly stated; and

(2) Identify all requirements which the offerors must fulfill and all other factors to be used in evaluating bids or proposals.

(d) The non-Federal entity must ensure that all prequalified lists of persons, firms, or products which are used in acquiring goods and services are current and include enough qualified sources to ensure maximum open and free competition. Also, the non-Federal entity must not preclude potential bidders from qualifying during the solicitation period.

78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75885, Dec. 19, 2014

2 C.F.R. § 200.320. Methods of procurement to be followed.

The non-Federal entity must use one of the following methods of procurement.

(a) Procurement by micro-purchases. Procurement by micro-purchase is the acquisition of supplies or services, the aggregate dollar amount of which does not exceed the micro-purchase threshold (§200.67 Micro-purchase). To the extent practicable, the non-Federal entity must distribute micro-purchases equitably among qualified suppliers. Micro-purchases may be awarded without soliciting competitive quotations if the non-Federal entity considers the price to be reasonable.

(b) Procurement by small purchase procedures. Small purchase procedures are those relatively simple and informal procurement methods for securing services, supplies, or other property that do not cost more than the Simplified Acquisition Threshold. If small purchase procedures are used, price or rate quotations must be obtained from an adequate number of qualified sources.

(c) Procurement by sealed bids (formal advertising). Bids are publicly solicited and a firm fixed price contract (lump sum or unit price) is awarded to the responsible bidder whose bid, conforming with all the material terms and conditions of the invitation for bids, is the lowest in price. The sealed bid method is the preferred method for procuring construction, if the conditions in paragraph (c)(1) of this section apply.

(1) In order for sealed bidding to be feasible, the following conditions should be present:

(i) A complete, adequate, and realistic specification or purchase description is available;

(ii) Two or more responsible bidders are willing and able to compete effectively for the business; and

(iii) The procurement lends itself to a firm fixed price contract and the selection of the successful bidder can be made principally on the basis of price.

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(2) If sealed bids are used, the following requirements apply:

(i) Bids must be solicited from an adequate number of known suppliers, providing them sufficient response time prior to the date set for opening the bids, for local, and tribal governments, the invitation for bids must be publicly advertised;

(ii) The invitation for bids, which will include any specifications and pertinent attachments, must define the items or services in order for the bidder to properly respond;

(iii) All bids will be opened at the time and place prescribed in the invitation for bids, and for local and tribal governments, the bids must be opened publicly;

(iv) A firm fixed price contract award will be made in writing to the lowest responsive and responsible bidder. Where specified in bidding documents, factors such as discounts, transportation cost, and life cycle costs must be considered in determining which bid is lowest. Payment discounts will only be used to determine the low bid when prior experience indicates that such discounts are usually taken advantage of; and

(v) Any or all bids may be rejected if there is a sound documented reason.

(d) Procurement by competitive proposals. The technique of competitive proposals is normally conducted with more than one source submitting an offer, and either a fixed price or cost-reimbursement type contract is awarded. It is generally used when conditions are not appropriate for the use of sealed bids. If this method is used, the following requirements apply:

(1) Requests for proposals must be publicized and identify all evaluation factors and their relative importance. Any response to publicized requests for proposals must be considered to the maximum extent practical;

(2) Proposals must be solicited from an adequate number of qualified sources;

(3) The non-Federal entity must have a written method for conducting technical evaluations of the proposals received and for selecting recipients;

(4) Contracts must be awarded to the responsible firm whose proposal is most advantageous to the program, with price and other factors considered; and

(5) The non-Federal entity may use competitive proposal procedures for qualifications-based procurement of architectural/engineering (A/E) professional services whereby competitors' qualifications are evaluated and the most qualified competitor is selected, subject to negotiation of fair and reasonable compensation. The method, where price is not used as a selection factor, can only be used in procurement of A/E professional services. It cannot be used to purchase other types of services though A/E firms are a potential source to perform the proposed effort.

(e) [Reserved]

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(f) Procurement by noncompetitive proposals. Procurement by noncompetitive proposals is procurement through solicitation of a proposal from only one source and may be used only when one or more of the following circumstances apply:

- (1) The item is available only from a single source;
- (2) The public exigency or emergency for the requirement will not permit a delay resulting from competitive solicitation;
- (3) The Federal awarding agency or pass-through entity expressly authorizes noncompetitive proposals in response to a written request from the non-Federal entity; or
- (4) After solicitation of a number of sources, competition is determined inadequate.

78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75885, Dec. 19, 2014; 80 FR 54409, Sept. 10, 2015

2 C.F.R. § 200.321. Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms.

- (a) The non-Federal entity must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.
- (b) Affirmative steps must include:
 - (1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
 - (2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
 - (3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
 - (4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;
 - (5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and
 - (6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (1) through (5) of this section.

69 FR 26280, May 11, 2004; 78 FR 78608, Dec. 26, 2013, unless otherwise noted

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2 C.F.R. § 200.322. Procurement of recovered materials.

A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75885, Dec. 19, 2014

2 C.F.R. § 200.323. Contract cost and price.

(a) The non-Federal entity must perform a cost or price analysis in connection with every procurement action in excess of the Simplified Acquisition Threshold including contract modifications. The method and degree of analysis is dependent on the facts surrounding the particular procurement situation, but as a starting point, the non-Federal entity must make independent estimates before receiving bids or proposals.

(b) The non-Federal entity must negotiate profit as a separate element of the price for each contract in which there is no price competition and in all cases where cost analysis is performed. To establish a fair and reasonable profit, consideration must be given to the complexity of the work to be performed, the risk borne by the contractor, the contractor's investment, the amount of subcontracting, the quality of its record of past performance, and industry profit rates in the surrounding geographical area for similar work.

(c) Costs or prices based on estimated costs for contracts under the Federal award are allowable only to the extent that costs incurred or cost estimates included in negotiated prices would be allowable for the non-Federal entity under Subpart E—Cost Principles of this part. The non-Federal entity may reference its own cost principles that comply with the Federal cost principles.

(d) The cost plus a percentage of cost and percentage of construction cost methods of contracting must not be used.

69 FR 26280, May 11, 2004; 78 FR 78608, Dec. 26, 2013, unless otherwise noted

2 C.F.R. § 200.324. Federal awarding agency or pass-through entity review.

(a) The non-Federal entity must make available, upon request of the Federal awarding agency or pass-through entity, technical specifications on proposed procurements where the Federal awarding agency or pass-through entity believes such review is needed to ensure that the item or service specified is the one being proposed for acquisition. This review generally will take place prior to the time the specification is incorporated into a solicitation document. However, if the non-Federal entity desires to have the review accomplished after a solicitation has been developed, the Federal awarding agency or pass-through entity may still review the specifications, with such review usually limited to the technical aspects of the proposed purchase.

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(b) The non-Federal entity must make available upon request, for the Federal awarding agency or pass-through entity pre-procurement review, procurement documents, such as requests for proposals or invitations for bids, or independent cost estimates, when:

(1) The non-Federal entity's procurement procedures or operation fails to comply with the procurement standards in this part;

(2) The procurement is expected to exceed the Simplified Acquisition Threshold and is to be awarded without competition or only one bid or offer is received in response to a solicitation;

(3) The procurement, which is expected to exceed the Simplified Acquisition Threshold, specifies a "brand name" product;

(4) The proposed contract is more than the Simplified Acquisition Threshold and is to be awarded to other than the apparent low bidder under a sealed bid procurement; or

(5) A proposed contract modification changes the scope of a contract or increases the contract amount by more than the Simplified Acquisition Threshold.

(c) The non-Federal entity is exempt from the pre-procurement review in paragraph (b) of this section if the Federal awarding agency or pass-through entity determines that its procurement systems comply with the standards of this part.

(1) The non-Federal entity may request that its procurement system be reviewed by the Federal awarding agency or pass-through entity to determine whether its system meets these standards in order for its system to be certified. Generally, these reviews must occur where there is continuous high-dollar funding, and third party contracts are awarded on a regular basis;

(2) The non-Federal entity may self-certify its procurement system. Such self-certification must not limit the Federal awarding agency's right to survey the system. Under a self-certification procedure, the Federal awarding agency may rely on written assurances from the non-Federal entity that it is complying with these standards. The non-Federal entity must cite specific policies, procedures, regulations, or standards as being in compliance with these requirements and have its system available for review.

69 FR 26280, May 11, 2004; 78 FR 78608, Dec. 26, 2013, unless otherwise noted

2 C.F.R. § 200.325. Bonding requirements.

For construction or facility improvement contracts or subcontracts exceeding the Simplified Acquisition Threshold, the Federal awarding agency or pass-through entity may accept the bonding policy and requirements of the non-Federal entity provided that the Federal awarding agency or pass-through entity has made a determination that the Federal interest is adequately protected. If such a determination has not been made, the minimum requirements must be as follows:

(a) A bid guarantee from each bidder equivalent to five percent of the bid price. The "bid guarantee" must consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of the bid, execute such contractual documents as may be required within the time specified.

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(b) A performance bond on the part of the contractor for 100 percent of the contract price. A “performance bond” is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under such contract.

(c) A payment bond on the part of the contractor for 100 percent of the contract price. A “payment bond” is one executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

69 FR 26280, May 11, 2004; 78FR 78608, Dec. 26, 2013, unless otherwise noted

2 C.F.R. § 200.326. Contract provisions.

The non-Federal entity's contracts must contain the applicable provisions described in Appendix II to Part 200—Contract Provisions for non-Federal Entity Contracts Under Federal Awards.

69 FR 26280, May 11, 2004; 78 FR 78608, Dec. 26, 2013, unless otherwise note

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2 C.F.R. Part, 200, Appendix II

In addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable.

(A) Contracts for more than the simplified acquisition threshold currently set at \$150,000, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

(B) All contracts in excess of \$10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement.

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

(D) Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

(E) Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or

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dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

(F) Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of “funding agreement” under 37 CFR §401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.

(G) Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended—Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

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

(I) Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)—Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(J) See §200.322 Procurement of recovered materials.

78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75888, Dec. 19, 2014

BID FORM
SAN LEON MUD MOTOR CONTROL CENTER
COUNTY OF GALVESTON, TEXAS

By signing here, the firm does hereby attest that it has fully read the instructions, conditions and general and special provisions and understands them.

THE COMPANY OF: _____

ADDRESS: _____

FEIN (TAX ID): _____

The following shall be returned with your bid. Failure to do so may be ample cause for rejection of bid as non-responsive. It is the responsibility of the Bidder to ensure that bidder has received all addenda.

Items:	Confirmed (X):
1. References (if required)	_____
2. Addenda, if any	#1_____ #2_____ #3_____ #4_____
3. One (1) original and three (3) copies of submittal	_____
4. Bid Form	_____
5. Vendor Qualification Packet	_____
6. Debarment Certification Form	_____
7. Non-Collusion Affidavit	_____
8. Form CIQ (sent to the Galveston County Clerk)	_____
9. Lobbying Certification	_____

Person to contact regarding this bid: _____

Title: _____ Phone: _____ Fax: _____

E-mail address: _____

Name of person authorized to bind the Firm: _____

Signature: _____ Date: _____

Title: _____ Phone: _____ Fax: _____

E-mail address: _____

BID FORM
SAN LEON MUD MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS

Bidder shall use this form to provide the information for notice.

1. Contact information for notice:

Name: _____
Address: _____

Telephone Number: _____ Facsimile number: _____

2. If a copy of notice is requested, please complete below:

Name: _____
Address: _____

Telephone Number: _____ Facsimile number: _____

3. If second or more copies are requested for notice, please supplement this form and clearly mark the supplement as "Supplementary Notice Information."

Bidder to submit reference information. Bidder shall use this form to provide minimum required reference information. If Bidder wishes to provide more than the minimum, Bidder should supplement this form and should clearly mark the supplement as "Supplementary Reference Information."

1. References who can attest to the Bidder's capability to carry out the requirements set forth in this bid:

Business Name of Organization: _____
Name of Person: _____
Title of Individual within Organization, if applicable _____
Business address: _____

Telephone number: _____ Facsimile number: _____

Business Name of Organization: _____
Name of Person: _____
Title of Individual within Organization, if applicable _____
Business address: _____

Telephone number: _____ Facsimile number: _____

Business Name of Organization: _____
Name of Person: _____
Title of Individual within Organization, if applicable _____
Business address: _____

Telephone number: _____ Facsimile number: _____

BID FORM
SAN LEON MOTOR CONTROL CENTER
GALVESTON COUNTY, TEXAS

References of major supplier of Bidder who can speak to the financial capability of the Bidder to carry out the requirements set forth in this bid:

1. Business Name of Supplier _____
Name of Person: _____
Title of Individual within business: _____
Business address: _____

Telephone number: _____ Facsimile number: _____

2. Business Name of Supplier _____
Name of Person: _____
Title of Individual within business: _____
Business address: _____

Telephone number: _____ Facsimile number: _____

3. Business Name of Supplier _____
Name of Person: _____
Title of Individual within business: _____
Business address: _____

Telephone number: _____ Facsimile number: _____

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CERTIFICATION REGARDING LOBBYING
(31 U.S.C.A. § 1352)
This Certification must be completed, signed, dated and
returned to the Galveston County Purchasing Agent

Procurement Number and Description: _____

Bid #B181051 San Leon MUD Motor Control Center

Proposer **CERTIFIES**, to the best of its knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the proposer, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the proposer shall complete and submit **Standard Form LLL**, "Disclosure Form to Report Lobbying", in accordance with its instructions.
3. Proposer shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

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

Name of Organization/Corporation: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Signature of Authorized Signatory for Proposer: _____ Date Signed: _____

Title of Authorized Signatory of Proposer: _____

State of Texas

§

County of Galveston

§

§

NON-COLLUSION AFFIDAVIT

Before me, the undersigned notary, on this day personally appeared _____ (Affiant), whom being first duly sworn, deposes and certifies that:

- Affiant is the _____ of _____, that
(Individual, Partner, Corporate Officer) (Name of Proposer)
submitted the attached Bid/Proposal in **Bid #B181051 San Leon MUD Motor Control Center**
- Affiant is a duly authorized representative of Proposer and is authorized to make this Non-Collusion Affidavit;
- The attached Proposal/Bid is genuine and is not a collusive or sham Proposal/Bid;
- The attached Proposal/Bid has been independently arrived at without collusion with any other bidder, proposer, person, firm, competitor, or potential competitor;
- Bidder/Proposer has not colluded, conspired, connived or agreed, directly or indirectly, with any other bidder, proposer, person, firm, competitor, or potential competitor, to submit a collusive or sham bid or that such other bidder, proposer, person, firm, competitor, or potential competitor shall refrain from bidding/proposing;
- Bidder/Proposer has not in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, proposer, person, firm, competitor, or potential competitor to fix the price or prices in the attached Bid/Proposal or of the bid/proposal any other bidder/proposer;
- Bidder/Proposer has not in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, proposer, person, firm, competitor, or potential competitor to fix the overhead, profit or cost element of the Bid/Proposal price or prices of any other bidder/proposer, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against Galveston County or any person interested in the proposed contract;
- Affiant has not in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, proposer, person, firm, competitor, or potential competitor, paid or agreed to pay any other bidder, proposer, person, firm, competitor, or potential competitor any money or anything of value in return for assistance in procuring or attempting to procure a contract or in return for establishing the price or prices in the attached Bid/Proposal or the bid/proposal of any other Bidder/Proposer; and
- Affiant certifies that Affiant is fully informed regarding the accuracy of the statements contained herein, and under penalties of perjury, certifies and affirms the truth of the statements herein, such penalties being applicable to the Bidder/Proposer as well as to Affiant signing on its behalf.

Signature of Affiant

SWORN TO and **SUBSCRIBED** before me this _____ day of _____, 2018.

Notary Public

My Commission Expires: _____



County of Galveston

**ACKNOWLEDGMENT AND CERTIFICATION REGARDING DEBARMENT,
SUSPENSION, AND OTHER INELGIBILITY
Executive Orders 12549 & 12689 Certification, Debarment and Suspension**

Solicitation Number: BID #B181051

Solicitation Title: SAN LEON MUD MOTOR CONTROL CENTER

Contractor hereby CERTIFIES that:

Contractor, and all of its principals, is not presently debarred, suspended, proposed for debarment, proposed for suspension, or declared ineligible under Executive Order 12549 or Executive Order 12689, Debarment and Suspension, and is not in any other way ineligible for participation in Federal or State assistance programs;

Contractor, and all of its principals, were not and have not been debarred, suspended, proposed for debarment, proposed for suspension, or declared ineligible under Executive Order 12549 or Executive Order 12689, Debarment and Suspension, and were not and have not been in any other way ineligible for participation in Federal or State assistance programs at the time its' proposal was submitted in the procurement identified herein and at any time since submission of its' proposal;

Contractor has included, and shall continue to include, this certification in all contracts between itself and any sub-contractors in connection with services performed under this contract; **and**

Contractor shall notify Galveston County in writing immediately, through written notification to the Galveston County Purchasing Agent, if Contractor is not in compliance with Executive Order 12549 or 12689 during the term of its contract with Galveston County.

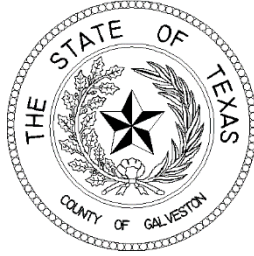
Contractor **Represents** and **Warrants** that the individual executing this Acknowledgment and Certification on its behalf has the full power and authority to do so and can legally bind the Contractor hereto.

Name of Business

Date

By: _____
Signature

Printed Name & Title



County of Galveston Purchasing Department Vendor Qualification Packet

(rev. 1.4, September 28, 2017)

All interested parties seeking consideration for qualified vendor status with the County of Galveston should complete and return only the following forms to:

Galveston County Purchasing Department
722 Moody Avenue, (21st Street), 5th Floor
Galveston, Texas 77550
(409) 770-5371 office
(409) 621-7987 fax

PEID Form: Person /Entity Information Data

W -9 Form: Request for Taxpayer Identification Number and Certification
(please note that the included form may not be the latest revised form issued by the Internal Revenue Service. Please check the IRS website at <http://www.irs.gov/pub/irs-rd/ffw9.pdf> for the latest revision of this form.)

CIQ Form: Conflict of Interest Questionnaire
(please note that the included form may not be the latest revised form issued by the State of Texas Ethics Commission. Please check the Texas Ethics Commission website at http://www.ethics.state.tx.us/whatsnew/conflict_forms.htm for the latest revision of this form. Please note that Galveston County Purchasing Agent is not responsible for the filing of this form with the Galveston County Clerk per instructions of the State of Texas Ethics Commission).

Debarment: **CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS & REQUIREMENT TO REGISTER IN SAM**

*Vendors/contractor certifies that neither it, nor any of its Principals, are presently debarred, suspended, proposed for debarment, disqualified, excluded, or in any way declared ineligible for the award of contracts by any Federal agency. Vendor agrees that it shall refund Galveston County for any payments made to Contractor while ineligible. Vendor acknowledges that Contractor's uncured failure to perform under any agreement with the County of Galveston, if such should occur, may result in Contractor being debarred from performing additional work for the County, the respecting State Agency administering the grant funding the contract, if applicable, the State, FEMA or HUD (as applicable), and other Federal and State entities. Further, Vendor has executed the Certification Regarding Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters and returned the fully completed and executed original certification with the submission of this Vendor Qualification Packet. **The truthful and fully completed and executed original of the Certification Regarding Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters must be included with the submission of this Vendor Qualification Packet and is a mandatory requirement to become a vendor of Galveston County. Vendor's failure to include the fully completed and executed original of this Certification shall be considered non-compliant with the requirements of this vendor qualification request and grounds for the rejection of vendor's request. Vendor shall immediately notify the County Purchasing Agent if it becomes debarred or suspended, placed on***

the Consolidated List of Debarred Contractors, or in any other way becomes ineligible for award of contract by any Federal agency. This Certification is a material fact relied upon by Galveston County; if it is later determined that the vendor did not comply with 2 C.F.R. Part 180 and 2 C.F.R. Part 3000, in addition to the remedies available to Galveston County and the State agency administering a grant, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment of contractor. If the contract to be awarded pursuant to a Galveston County procurement effort involves the use of Federal funds, then vendor must also be registered in the Federal Contractor Registry through the System for Award Management (SAM) to be eligible for award of contract pursuant to the procurement.

Information regarding the SAM is available at:

<http://www.federalcontractorregistry.com/?gclid=CIG1hf2rr8wCFYkCaQoducANZw> or at <https://www.sam.gov/portal/SAM/#1>.

No contract involving the use of Federal funds may be awarded to any vendor unless and until such registration is current and in good standing under SAM. Successful vendors must maintain SAM registration throughout the entire term of any contractual agreement with the County. If a contract involves the use of Federal funds, then vendor must enclose proof of such SAM registration within its response, which is also a mandatory requirement of County procurement policy; failure to enclose such proof shall be considered non-compliant with the requirements of any procurement effort and grounds for the rejection of vendor's response to any procurement efforts (i.e., bid, proposal, or qualifications statement, as applicable).

Direct Deposit: Direct Deposit Authorization Form

Banking made easier through an ACH Vendor Payment service (direct deposit) available from Galveston County. With an ACH Vendor Payment, payments are deposited directly into a checking or savings account at a designated bank, savings and loan, credit union, or any other member of an automated clearing house.

Certificate(s) of Insurance: If the person or entity seeking qualified vendor status with the County will be performing work at or on any County owned facility and/or property, Certificate(s) of Insurance are required to be submitted prior to performing any work.

Insurance requirements are as follows:

Public Liability and Property Damage Insurance:

Successful vendor agrees to keep in full force and effect, a policy of public liability and property damage insurance issued by a casualty company authorized to do business in the State of Texas, and in standard form approved by the Board of Insurance Commissioners of the State of Texas, with coverage provisions insuring the public from any loss or damage that may arise to any person or property by reason of services rendered by vendor. Vendor shall at its own expense be required to carry the following minimum insurance coverages:

1. For damages arising out of bodily injury to or death of one person in anyone occurrence - one hundred thousand and no/100 dollars (\$100,000.00);
2. For damages arising out of bodily injury to or death of two or more persons in anyone occurrence - three hundred thousand and no/100 dollars (\$300,000.00); and
3. For injury to or destruction of property in anyone occurrence - one hundred thousand and no/100 dollars (\$100,000.00).

This insurance shall be either on an occurrence basis or on a claims made basis. Provided however, that if the coverage is on a claims made basis, then the vendor shall be required to purchase, at the termination of this agreement, tail coverage for the County for the period of the County's relationship with the vendor under this agreement. Such coverage shall be in the amounts set forth in subparagraphs (1), (2), and (3) above.

Worker's Compensation Insurance:

Successful vendor shall also carry in full force Workers' Compensation Insurance policy(ies), if there is more than one employee, for all employees, including but not limited to full time, part time, and emergency employees employed by the vendor. Current insurance certificates certifying that such policies as specified above are in full force and effect shall be furnished by the vendor to the County.

The County of Galveston shall be named as additional insured on policies listed in subparagraphs above and shall be notified of any changes to the policy(ies) during the contractual period.

Insurance is to be placed with insurers having a Best rating of no less than A. The vendor shall furnish the County with certificates of insurance and original endorsements affecting coverage required by these insurance clauses. The certificates and endorsements for each insurance policy are to be signed by a person authorized by the insurer to bind coverage on its behalf. The vendor shall be required to submit annual renewals for the term of any contractual agreement, purchase order or term contract, with Galveston County prior to expiration of any policy.

In addition to the remedies stated herein, the County has the right to pursue other remedies permitted by law or in equity.

The County agrees to provide vendor with reasonable and timely notice of any claim, demand, or cause of action made or brought against the County arising out of or related to utilization of the property. Vendor shall have the right to defend any such claim, demand, or cause of action at its sole cost and expense and within its sole and exclusive discretion. The County agrees not to compromise or settle any claim or cause of action arising out of or related to the utilization of the property without the prior written consent of the vendor.

In no event shall the County be liable for any damage to or destruction of any property belonging to the vendor unless specified in writing and agreed upon by both parties.

Procurement Policy - Special Note:

Understand that it is, according to Texas Local Government Code, Section 262.011, Purchasing Agents, subsections (d), (e), and (f), the sole responsibility of the Purchasing Agent to supervise all procurement transactions.

Therefore, be advised that all procurement transactions require proper authorization in the form of a Galveston County purchase order from the Purchasing Agent's office prior to commitment to deliver supplies, materials, equipment, including contracts for repair, service, and maintenance agreements. Any commitments made without proper authorization from the Purchasing Agent's office, pending Commissioners' Court approval, may become the sole responsibility of the individual making the commitment including the obligation of payment.

Code of Ethics - Statement of Purchasing Policy:

Public employment is a public trust. It is the policy of Galveston County to promote and balance the objective of protecting the County's integrity and the objective of facilitating the recruitment and retention of personnel needed by Galveston County. Such policy is implemented by prescribing essential standards of ethical conduct without creating unnecessary obstacles to entering public office.

Public employees must discharge their duties impartially so as to assure fair competitive access to governmental procurement by responsible contractors. Moreover, they should conduct themselves in such a manner as to foster public confidence in the integrity of the Galveston County procurement organization.

To achieve the purpose of these instructions, it is essential that those doing business with Galveston County also observe the ethical standards prescribed here.

General Ethical Standards: It shall be a breach of ethics to attempt to realize personal gain through public employment with Galveston County by any conduct inconsistent with the proper discharge of the employee's duties.

It shall be a breach of ethics to attempt to influence any public employee of Galveston County to breach the standards of ethical conduct set forth in this code.

It shall be a breach of ethics for any employee of Galveston County to participate directly or indirectly in procurement when the employee knows that:

- The employee or any member of the employee's immediate family has a financial interest pertaining to the procurement.
- A business or organization in which the employee, or any member of the employee's immediate family, has a financial interest pertaining to the procurement.
- Any other person, business or organization with which the employee or any member of the employee's immediate family is negotiating or has an arrangement concerning prospective employment is involved in the procurement.

Gratuities: It shall be a breach of ethics to offer, give or agree to give any employee of Galveston County, or for any employee or former employee of Galveston County to solicit, demand, accept or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, preparation of any part of a program requirement or purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any program requirement or a contract or subcontract, or to any solicitation or proposal therefore pending before this government.

Kickbacks: It shall be a breach of ethics for any payment, gratuity or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor for any contract for Galveston County, or any person associated therewith, as an inducement for the award of a subcontract or order.

Contract Clause: The prohibition against gratuities and kickbacks prescribed above shall be conspicuously set forth in every contract and solicitation by Galveston County.

Confidential Information: It shall be a breach of ethics for any employee or former employee of Galveston County to knowingly use confidential information for actual or anticipated personal gain, or for the actual or anticipated gain of any person.

Questions/Concerns:

If you have any questions or concerns regarding the information or instructions contained within this packet, please contact any member of the Purchasing Department staff at **(409) 770-5371**.

CONFLICT OF INTEREST DISCLOSURE REPORTING

Proposer may be required under Chapter 176 of the Texas Local Government Code to complete and file a conflict of interest questionnaire (CIQ Form). If so, the completed CIQ Form must be filed with the County Clerk of Galveston County, Texas.

If Proposer has an employment or other business relationship with an officer of Galveston County or with a family member of an officer of Galveston County that results in the officer or family member of the officer receiving taxable income that exceeds \$2,500.00 during the preceding 12-month period, then Proposer **MUST** complete a CIQ Form and file the original of the CIQ Form with the County Clerk of Galveston County.

If Proposer has given an officer of Galveston County or a family member of an officer of Galveston County one or more gifts with an aggregate value of more than \$250.00 during the preceding 12-months, then Proposer **MUST** complete a CIQ Form and file the original of the CIQ Form with the County Clerk of Galveston County.

The Galveston County Clerk has offices at the following locations:

Galveston County Clerk
Galveston County Justice Center, Suite 2001
600 59th Street
Galveston, Texas 77551

Galveston County Clerk
North County Annex, 1st Floor
174 Calder Road
League City, Texas 77573

Again, if Proposer is required to file a CIQ Form, the original completed form is filed with the Galveston County Clerk (not the Purchasing Agent).

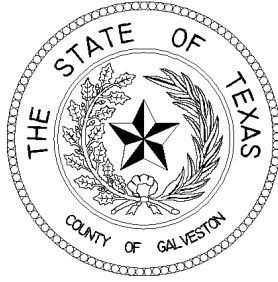
For Proposer's convenience, a blank CIQ Form is enclosed with this proposal. Blank CIQ Forms may also be obtained by visiting the Galveston County Clerk's website and/or the Purchasing Agent's website - both of these web sites are linked to the Galveston County homepage, at <http://www.co.galveston.tx.us>.

As well, blank CIQ Forms may be obtained by visiting the Texas Ethics Commission website, specifically at <http://www.ethics.state.tx.us/whatsnew/conflictforms.htm>.

Chapter 176 specifies deadlines for the filing of CIQ Forms (both initial filings and updated filings).

It is Proposer's sole responsibility to file a true and complete CIQ Form with the Galveston County Clerk if Proposer is required to file by the requirements of Chapter 176. Proposer is advised that it is an offense to fail to comply with the disclosure reporting requirements dictated under Chapter 176 of the Texas Local Government Code.

If you have questions about compliance with Chapter 176, please consult your own legal counsel. Compliance is the individual responsibility of each person, business, and agent who is subject to Chapter 176 of the Texas Local Government Code.



COUNTY of GALVESTON

Purchasing Department

rev. 1.3, March 29, 2010

FORM PEID:	Request for Person-Entity Identification Data
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Instructions: Please type or print clearly when completing sections 1 thru 4 and return completed form to:

Galveston County Purchasing Agent
722 Moody Avenue (21 st. Street), 5th Floor
Galveston, Texas 77550
(409) 770-5371
prodoc@co.galveston.tx.us

1.	Business Name:			
	Attention Line:			
2.	Physical Address:			
	City:		State:	Zip+4:
3.	Billing / Remit Address:			
	City:		State:	Zip+4
4.	Main Contact Person:			
	Main Phone Number:			
	Fax Number:			
	E-mail Address:			

Areas below are for County use only.

Requested By:	Phone / Ext. #
Department:	Date:

Action Requested - Check One:	IFAS PEID Vendor Number:	
<input type="checkbox"/> Add New	<input type="checkbox"/> Change Data	<input type="checkbox"/> Re-activate
<input type="checkbox"/> Inactivate	<input type="checkbox"/> Employee	<input type="checkbox"/> Attorney
<input type="checkbox"/> Landlord	<input type="checkbox"/> Foster Parent	<input type="checkbox"/> Refund
<input type="checkbox"/> OneTime	<input type="checkbox"/> Foster Child	

Request for Taxpayer Identification Number and Certification

**Give Form to the
 requester. Do not
 send to the IRS.**

Print or type See Specific Instructions on page 2.	1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.	
	2 Business name/disregarded entity name, if different from above	
	3 Check appropriate box for federal tax classification; check only one of the following seven boxes: <input type="checkbox"/> Individual/sole proprietor or single-member LLC <input type="checkbox"/> C Corporation <input type="checkbox"/> S Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Trust/estate <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶ _____ Note. For a single-member LLC that is disregarded, do not check LLC; check the appropriate box in the line above for the tax classification of the single-member owner. <input type="checkbox"/> Other (see instructions) ▶ _____	4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3): Exempt payee code (if any) _____ Exemption from FATCA reporting code (if any) _____ <small>(Applies to accounts maintained outside the U.S.)</small>
	5 Address (number, street, and apt. or suite no.)	Requester's name and address (optional)
	6 City, state, and ZIP code	
	7 List account number(s) here (optional)	

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the instructions for line 1 and the chart on page 4 for guidelines on whose number to enter.

Social security number					
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Part II Certification

Under penalties of perjury, I certify that:

- The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
- I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
- I am a U.S. citizen or other U.S. person (defined below); and
- The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3.

Sign Here	Signature of U.S. person ▶	Date ▶
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General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. Information about developments affecting Form W-9 (such as legislation enacted after we release it) is at www.irs.gov/fw9.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following:

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)

- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
 - Form 1099-C (canceled debt)
 - Form 1099-A (acquisition or abandonment of secured property)
- Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.
- If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding? on page 2.*
- By signing the filled-out form, you:
- Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
 - Certify that you are not subject to backup withholding, or
 - Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
 - Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting?* on page 2 for further information.

Note. If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States:

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Publication 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items:

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 28% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,
2. You do not certify your TIN when required (see the Part II instructions on page 3 for details),

3. The IRS tells the requester that you furnished an incorrect TIN,

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code* on page 3 and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships* above.

What is FATCA reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code* on page 3 and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of \$50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a \$500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account, list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note. ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C Corporation, or S Corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box in line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box in line 3.

Limited Liability Company (LLC). If the name on line 1 is an LLC treated as a partnership for U.S. federal tax purposes, check the "Limited Liability Company" box and enter "P" in the space provided. If the LLC has filed Form 8832 or 2553 to be taxed as a corporation, check the "Limited Liability Company" box and in the space provided enter "C" for C corporation or "S" for S corporation. If it is a single-member LLC that is a disregarded entity, do not check the "Limited Liability Company" box; instead check the first box in line 3 "Individual/sole proprietor or single-member LLC."

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space in line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

- 1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)
- 2—The United States or any of its agencies or instrumentalities
- 3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities
- 4—A foreign government or any of its political subdivisions, agencies, or instrumentalities
- 5—A corporation
- 6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession
- 7—A futures commission merchant registered with the Commodity Futures Trading Commission
- 8—A real estate investment trust
- 9—An entity registered at all times during the tax year under the Investment Company Act of 1940
- 10—A common trust fund operated by a bank under section 584(a)
- 11—A financial institution
- 12—A middleman known in the investment community as a nominee or custodian
- 13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over \$600 required to be reported and direct sales over \$5,000 ¹	Generally, exempt payees 1 through 5 ²
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

¹ See Form 1099-MISC, Miscellaneous Income, and its instructions.

² However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note. You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN. However, the IRS prefers that you use your SSN.

If you are a single-member LLC that is disregarded as an entity separate from its owner (see *Limited Liability Company (LLC)* on this page), enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note. See the chart on page 4 for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at www.ssa.gov. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at www.irs.gov/businesses and clicking on Employer Identification Number (EIN) under Starting a Business. You can get Forms W-7 and SS-4 from the IRS by visiting IRS.gov or by calling 1-800-TAX-FORM (1-800-829-3676).

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note. Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if items 1, 4, or 5 below indicate otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code* earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

- 1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983.** You must give your correct TIN, but you do not have to sign the certification.
- 2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983.** You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.
- 3. Real estate transactions.** You must sign the certification. You may cross out item 2 of the certification.
- 4. Other payments.** You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).
- 5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions.** You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account)	The actual owner of the account or, if combined funds, the first individual on the account ¹
3. Custodian account of a minor (Uniform Gift to Minors Act)	The minor ²
4. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law	The grantor-trustee ¹ The actual owner ¹
5. Sole proprietorship or disregarded entity owned by an individual	The owner ³
6. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	Give name and EIN of:
7. Disregarded entity not owned by an individual	The owner
8. A valid trust, estate, or pension trust	Legal entity ⁴
9. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
10. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
11. Partnership or multi-member LLC	The partnership
12. A broker or registered nominee	The broker or nominee
13. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
14. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

¹ List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

² Circle the minor's name and furnish the minor's SSN.

³ You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

⁴ List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships* on page 2.

*Note. Grantor also must provide a Form W-9 to trustee of trust.

Note. If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records from Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Publication 4535, Identity Theft Prevention and Victim Assistance.

Victims of identity theft who are experiencing economic harm or a system problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to phishing@irs.gov. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at: spam@uce.gov or contact them at www.ftc.gov/idtheft or 1-877-IDTHEFT (1-877-438-4338).

Visit IRS.gov to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor or other person doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 1491, 80th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code by a person who has a business relationship as defined by Section 176.001 (1-a) with a local governmental entity and the person meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code.

A person commits an offense if the person knowingly violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

OFFICE USE ONLY

Date Received

1 Name of person who has a business relationship with local governmental entity.

2 Check this box if you are filing an update to a previously filed questionnaire.

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

3 Name of local government officer with whom filer has employment or business relationship.

Name of Officer

This section (item 3 including subparts A, B, C & D) must be completed for each *officer* with whom the filer has an employment or other business relationship as defined by Section 176.001 (1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the filer of the questionnaire?

Yes

NO

B. Is the filer of the questionnaire receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government *officer* named in this section AND the taxable income is not received from the local governmental entity?

Yes

NO

C. Is the filer of this questionnaire employed by a corporation or other business entity with respect to which the local government officer serves as an *officer* or director, or holds an ownership of 10 percent or more?

Yes

NO

D. Describe each employment or business relationship with the local government *officer* named in this section.

4

Signature of person doing business with the governmental entity

Date



County of Galveston

ACKNOWLEDGMENT AND CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER INELIGIBILITY

Executive Orders 12549 & 12689 Certification, Debarment and Suspension

Solicitation Number: _____

Solicitation Title: _____

Contractor hereby CERTIFIES that:

Contractor, and all of its principals, is not presently debarred, suspended, proposed for debarment, proposed for suspension, or declared ineligible under Executive Order 12549 or Executive Order 12689, Debarment and Suspension, and is not in any other way ineligible for participation in Federal or State assistance programs;

Contractor, and all of its principals, were not and have not been debarred, suspended, proposed for debarment, proposed for suspension, or declared ineligible under Executive Order 12549 or Executive Order 12689, Debarment and Suspension, and were not and have not been in any other way ineligible for participation in Federal or State assistance programs at the time its' proposal was submitted in the procurement identified herein and at any time since submission of its' proposal;

Contractor has included, and shall continue to include, this certification in all contracts between itself and any sub-contractors in connection with services performed under this contract; **and**

Contractor shall notify Galveston County in writing immediately, through written notification to the Galveston County Purchasing Agent, if Contractor is not in compliance with Executive Order 12549 or 12689 during the term of its contract with Galveston County.

Contractor **Represents** and **Warrants** that the individual executing this Acknowledgment and Certification on its behalf has the full power and authority to do so and can legally bind the Contractor hereto.

Name of Business

Date

By: _____
Signature

Printed Name & Title



You can make your banking easier through an ACH Vendor Payment service (direct deposit) available from Galveston County. With an ACH Vendor Payment, you can choose to have your payments deposited directly into your checking or savings account at your designated bank, savings and loan, credit union, or any other member of an automated clearing house.

Direct deposit is safe. No worries about lost or stolen checks. No danger of fraud or forged checks.

You will receive your notice of deposit by email along with the same payment information previously noted on your check stub.

Your payments should be available in your account as approved by commissioner's court. The funds will be sent to your financial institution upon approval of the court.

Once you start direct deposit you will need to notify us in writing immediately if you change banks or account numbers. We will need at least a two week written notice to stop any direct deposit.

Thank You,

A handwritten signature in black ink, appearing to read "K Walsh", is written over the "Thank You," text.

Kevin C. Walsh, CPA
Galveston County Treasurer



**GALVESTON COUNTY DIRECT DEPOSIT
VENDOR/EMPLOYEE AUTHORIZATION FORM**

County EMPLOYEE County VENDOR

NAME (please Print or Type): _____

TIN#/SSN#/EMPLOYEE ID: _____

ADDRESS: _____

TELEPHONE NUMBER: _____ CONTACT PERSON: _____

EMAIL (*required): _____

I (We) authorize Galveston County, to deposit payments into my (our) account. If Galveston County erroneously deposits funds into my (our) account, I (we) authorize Galveston County to initiate the necessary debit entries, not to exceed the total of the original amount credited for the current payment. This authorization will remain in effect until Galveston County has received written notice of termination and Galveston County has had reasonable opportunity to act on it. I (we) understand that a notice of deposit will be emailed by the Galveston County Treasurer's office. To make any changes, I (we) agree to submit a new Direct Deposit Authorization form with the updated information. If any action or inaction taken by the vendor results in non-acceptance of a direct deposit by the Financial Institution, vendor acknowledges that Galveston County has no responsibility to issue another payment until the funds are returned to the County. If non-acceptance by the Financial Institution is the result of action or non-action by the vendor, late fees and penalties do not apply to Galveston County and Galveston County is not responsible for any bank fees you may incur.

FINANCIAL INSTITUTION NAME: _____

CITY: _____ STATE: _____ ZIP: _____

ROUTING NUMBER: _____ BANK ACCOUNT NO: _____

CHECKING SAVINGS

ATTACH A VOIDED CHECK/OFFICIAL DOCUMENTATION FROM FINANCIAL INSTITUTION

I (We) decline Galveston County's offer of direct deposit payments into my (our) account. I (we) understand that the decision to opt into direct deposit can be changed at any time by submitting a new Direct Deposit Authorization form.

PRINTED NAME: _____ TITLE: _____

AUTHORIZED SIGNATURE: _____ DATE: _____

PLEASE RETURN THIS FORM TO THE GALVESTON COUNTY TREASURER'S OFFICE

722 Moody Ave-4th Floor, Galveston, TX 77550 Phone: 409-770-5395, Fax: 409-770-5386, Email: EFTPAY@co.galveston.tx.us

For Office Use Only

PEID#: _____ Entered By: _____ Date Entered: _____

SPECIAL PROVISIONS FOR CONSTRUCTION

1. Contract and Contract Documents

- (a) The project to be constructed pursuant to this contract will be financed with assistance from the Community Disaster Block Grant "CDBG" and is subject to all applicable Federal and State laws and regulations.
- (b) The Plans, Specifications and Addenda, hereinafter enumerated in Paragraph 1 of the Supplemental General Conditions shall form part of this contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth.

2. Definitions

Whenever used in any of the contract Documents, the following meanings shall be given to the terms here in defined:

- (a) The term "Contract" means the Contract executed between Galveston County, hereinafter called the Owner and _____ hereinafter called Contractor, of which these GENERAL CONDITIONS, form a part.
- (b) The term "Project Area" means the area within which are the specified Contract limits of the Improvements contemplated to be constructed in whole or in part under this contract.
- (c) The term "Engineer" means Hatch Associates Consultant Inc, Engineer in charge, serving the Owner with architectural or engineering services, his successor, or any other person or persons, employed by the Owner for the purpose of directing or having in charge the work embraced in this Contract.
- (d) The term "Contract Documents" means and shall include the following: Executed Contract, Addenda (if any), Invitation for Bids, Instructions to Bidders, Signed Copy of Bid, General Conditions, Special Conditions, Technical Specifications, and Drawings (as listed in the Schedule of Drawings).

3. Supervision By Contractor

- (a) Except where the Contractor is an individual and gives his personal supervision to the work, the Contractor shall provide a competent superintendent, satisfactory to the Local Public Agency and the Engineer, on the work at all times during working hours with full authority to act for him. The Contractor shall also provide an adequate staff for the proper coordination and expediting of his work.
- (b) The Contractor shall lay out his own work and he shall be responsible for all work executed by him under the Contract. He shall verify all figures and elevations before proceeding with the work and will be held responsible for any error resulting from his failure to do so.

4. Subcontracts

- (a) The Contractor shall not execute an agreement with any subcontractor or permit any subcontractor to perform any work included in this contract until he has verified the subcontractor as eligible to participate in federally funded contracts.
- (b) No proposed subcontractor shall be disapproved by the city/county except for cause.

- (c) The Contractor shall be as fully responsible to the city/county for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them.
- (d) The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work and required compliance by each subcontractor with the applicable provisions of the Contract.
- (e) Nothing contained in the Contract shall create any contractual relation between any subcontractor and the Owner.

5. Fitting and Coordination of Work

The Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors, or material suppliers engaged upon this Contract.

6. Payments to Contractor

(a) Partial Payments

- 1) The Contractor shall prepare his requisition for partial payment as of the last day of the month and submit it, with the required number of copies, to the Engineer for his approval. The amount of the payment due the Contractor shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting (1) five percent (5%) of the total amount, to be retained until final payment and (2) the amount of all previous payments. The total value of work completed to date shall be based on the estimated quantities of work completed and on the unit prices contained in the agreement. The value of materials properly stored on the site shall be based upon the estimated quantities of such materials and the invoice prices. Copies of all invoices shall be available for inspection of the Engineer.
- 2) Monthly or partial payments made by the Owner to the Contractor are moneys advanced for the purpose of assisting the contractor to expedite the work of construction. The Contractor shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the Owner. Such payments shall not constitute a waiver of the right of the Owner to require the fulfillment of all terms of the Contract and the delivery of all improvements embraced in this Contract complete and satisfactory to the Owner in all details.

(b) Final Payment

- 1) After final inspection and acceptance by the Owner of all work under the Contract, the Contractor shall prepare his requisition for final payment which shall be based upon the careful inspection of each item of work at the applicable unit prices stipulated in the Agreement. The total amount of the final payment due the Contractor under this contract shall be the amount computed as described above less all previous payments.
- 2) The Owner before paying the final estimate, shall require the Contractor to furnish releases or receipts from all subcontractors having performed any work and all persons having supplied materials, equipment (installed on the Project) and services to the Contractor, if the Owner deems it necessary in order to protect its interest. The Owner may, if it deems such action advisable, make payment in part or in full to the Contractor without requiring the furnishing of such releases or receipts and any payments made shall in no way impair the obligations of any surety or sureties furnished under this Contract.
- 3) Any amount due the Owner under Liquidated Damages, shall be deducted from the final payment due the contractor.

(c) Payments Subject to Submission of Certificates

Each payment to the Contractor by the Owner shall be made subject to submission by the Contractor of all written certifications required of him and his subcontractors.

(d) Withholding Payments

The Owner may withhold from any payment due the Contractor whatever is deemed necessary to protect the Owner, and if so elects, may also withhold any amounts due from the Contractor to any subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and will not require the Owner to determine or adjust any claims or disputes between the Contractor and his subcontractors or material dealers, or to withhold any moneys for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any moneys from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this Contract.

7. Estimated Quantities

This Contract, including the specifications, plans and estimates, is intended to show clearly all the work to be done and material to be furnished hereunder. The estimated quantities of the various classes of work to be done and material to be furnished under this contract are approximate and are to be used as a basis for estimating the probable cost of the work and for comparing the proposals offered for the work. It is understood and agreed that the actual amount of work to be done and material to be furnished under this contract may differ somewhat from these estimates, and that the basis for payment under this contract shall be the plan quantity or actual amount of such work done whichever is specified. It is further understood that the County does not guarantee any minimum amount of work under this Contract.

Contractor agrees that it will make no claim for damages, anticipated profits or otherwise on account of any differences which may be found between the quantities of work actually done, the material actually furnished under this Contract and the estimated quantities contemplated and contained in the proposals.

8. Changes in the Work

- (a) The Owner may make changes in the scope of work required to be performed by the Contractor under the Contract without relieving or releasing the Contractor from any of his obligations under the Contract or any guarantee given by him pursuant to the Contract provisions, and without affecting the validity of the guaranty bonds, and without relieving or releasing the surety or sureties of said bonds. All such work shall be executed under the terms of the original Contract unless it is expressly provided otherwise. Additionally, all such change orders must be approved by the CDBG staff prior to execution of same.
- (b) Except for the purpose of affording protection against any emergency endangering health, life, limb or property, the Contractor shall make no change in the materials used or in the specified manner of constructing and/or installing the improvements or supply additional labor, services or materials beyond that actually required for the execution of the Contract, unless in pursuance of a written order from the Owner authorizing the Contractor to proceed with the change. No claim for an adjustment of the Contract Price will be valid unless so ordered.
- (c) It is agreed that Contractor shall perform all Extra Work under the direction of the Owner when presented with a Written Work Order signed by the Owner: subject, however, to the right of Contractor to require a written confirmation of such Extra Work Order by the County Commissioners' Court. It is

also agreed that the compensation to be paid Contractor for performing said Extra Work shall be determined by one or more of the following methods:

- Method (a) - By agreed unit prices; or
- Method (b) - By agreed lump sum: or
- Method (c) - If Neither Method (a) nor Method (b) can be agreed upon before the Extra Work is commenced, then Contractor shall be paid the "Actual field cost" of the work plus fifteen (15) percent.

In the event said Extra Work be performed and paid for under Method (c), then the provisions of this paragraph shall apply and the "actual field cost" is hereby defined to include the cost of all workmen, such as foremen, timekeepers, merchants, and laborers, and materials, supplies, teams, trucks, rentals on machinery and equipment for time actually employed or used on such Extra Work plus actual transportation charges necessarily incurred, if the kind of equipment or machinery is not already on the job, together with all power, fuel, lubricants, water and similar operating expenses, also all necessary incidental expenses incurred directly on account of such Extra Work including Social Security, Old Age Benefits and other payroll taxes, and a ratable proportion of premiums on Construction and Maintenance Bonds, Public Liability and Property Damage and Workmen's Compensation, and all other insurance as may be required by any law or ordinance, or directed by the Owner or by him agreed. The Owner may direct the form in which accounts of the "actual field cost" shall be kept and may also specify in writing, before the work commences, the method of doing the work and the type and kind of machinery and equipment to be used, otherwise these matters shall be determined by Contractor. Unless otherwise agreed upon, the prices for the use of machinery and equipment shall be determined by using the one hundred (100) percent of the actual hourly or daily rate (for the time used plus time in moving to and from Job) of the latest schedule of Equipment Ownership Expense adopted by the Association General Contractors of America. Where practicable the terms and prices for the use of Machinery and Equipment shall be incorporated in the Written Extra Work Order. The fifteen (15) percent of the "Actual Field Cost" to be paid Contractor shall cover and compensate him for his profit, overhead, general superintendence and field office expense, and all other elements of cost and expense not embraced within the 'actual field cost" as herein defined, save that where the Contractor's Camp or Field Office must be maintained primarily on account of such extra work, then the cost to maintain and operate same shall be included in the "actual field cost".

No claim for extra work of any kind will be allowed unless ordered in writing by the Owner. In case any orders or instructions, either oral or written appear to Contractor to involve extra work for which he should receive compensation, it shall make written request to the Program Administrator for written order authorizing Extra Work. Should a difference of opinion arise as to what does or does not constitute extra work, or as to the payment therefor, and the Owner insists upon its performance, Contractor shall proceed with the work after making written order and shall keep an accurate account of the "actual field cost" thereof, as provided under Method (c) and by this action Contractor will thereby preserve the right to submit the matter of payment to litigation.

(d) Each change order shall include in its final form:

- 1) A detailed description of the change in the work.
- 2) The Contractor's proposal (if any) or a confirmed copy thereof.
- 3) A definite statement as to the resulting change in the contract price and/or time.
- 4) The statement that all work involved in the change shall be performed in accordance with contract requirements except as modified by the change order.

5) The procedures as outlined in this Section for a unit price contract also apply in any lump sum contract.

9. Claims for Extra Cost

- (a) If the Contractor claims that any instructions by Drawings or otherwise involve extra cost or extension of time, he shall, within ten days after the receipt of such instructions, and in any event before proceeding to execute the work, submit his protest thereto in writing to the Owner, stating clearly and in detail the basis of his objections. No such claim will be considered unless so made.
- (b) Claims for additional compensation for extra work, due to alleged errors in ground elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work, than would be reasonably estimated from the Drawings and maps issued.
- (c) Any discrepancies which may be discovered between actual conditions and those represented by the Drawings and maps shall be reported at once to the Owner and work shall not proceed except at the Contractor's risk, until written instructions have been received by him from the Owner.
- (d) If, on the basis of the available evidence, the Owner determines that an adjustment of the Contract Price and/or time is justifiable, a change order shall be executed.

10. Liquidated Damages

If the work is not completed within the time stipulated in the applicable bid for Lump Sum or Unit Price Contract provided, the Contractor shall pay to the Owner as fixed, agreed, and liquidated damages (it being impossible to determine the actual damages occasioned by the delay) the amount of **One Thousand Dollars (\$1,000.00)** for each calendar day of delay, until the work is completed. The Contractor and his sureties shall be liable to the Owner for the amount thereof.

11. Disputes

- (a) All disputes arising under this Contract or its interpretation except those disputes covered by FEDERAL LABOR STANDARDS PROVISIONS whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall, within ten (10) days of commencement of the dispute, be presented by the Contractor to the Owner for decision. Any claim not presented within the time limit specified in this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten (10) days of its commencement, the claim will be considered only for a period commencing ten (10) days prior to the receipt of the Owner.
- (b) The Contractor shall submit in detail his claim and his proof thereof.
- (c) If the Contractor does not agree with any decision of the Owner, he shall in no case allow the dispute to delay the work but shall notify the Owner promptly that he is proceeding with the work under protest.

12. Technical Specifications and Drawings

Anything mentioned in the Technical Specifications and not shown on the Drawings or vice versa, shall be of like effect as if shown on or mentioned in both. In case of difference between Drawings and Technical

Specifications, the Technical Specifications shall govern. In case of any discrepancy in Drawings, or Technical Specifications, the matter shall be immediately submitted to the Owner, without whose decision, said discrepancy shall not be adjusted by the Contractor, save only at his own risk and expense.

13. Shop Drawings

- (a) All required shop drawings, machinery details, layout drawings, etc. shall be submitted to the Engineer in 6 copies for approval sufficiently in advance of requirements to afford ample time for checking, including time for correcting, resubmitting and rechecking if necessary. The Contractor may proceed, only at his own risk, with manufacture or installation of any equipment or work covered by said shop drawings, etc. until they are approved and no claim, by the Contractor, for extension of the contract time shall be granted by reason of his failure in this respect.
- (b) Any drawings submitted without the Contractor's stamp of approval will not be considered and will be returned to him for proper resubmission. If any drawings show variations from the requirements of the Contract because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment of contract price and/or time, otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though the drawings have been approved.
- (c) If a shop drawing is in accordance with the contract or involves only a minor adjustment in the interest of the Owner not involving a change in contract price or time; the engineer may approve the drawing. The approval shall not relieve the Contractor from his responsibility for adherence to the contract or for any error in the drawing.

14. Requests for Supplementary Information

It shall be the responsibility of the Contractor to make timely requests of the Owner for any additional information not already in his possession which should be furnished by the Owner under the terms of this Contract, and which he will require in the planning and execution of the work. Such requests may be submitted from time to time as the need approaches, but each shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing, and list the various items and the latest date by which each will be required by the Contractor. The first list shall be submitted within two weeks after Contract award and shall be as complete as possible at that time. The Contractor shall, if requested, furnish promptly any assistance and information the Engineer may require in responding to these requests of the Contractor. The Contractor shall be fully responsible for any delay in his work or to others arising from his failure to comply fully with the provision of this section.

15. Materials and Workmanship

- (a) Unless otherwise specifically provided for in the technical specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose. Where equipment, materials, articles or workmanship are referred to in the technical specifications as "equal to" any particular standard, the Engineer shall decide the question of equality.
- (b) The Contractor shall furnish to the Owner for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required, and shall likewise submit for approval full information concerning all other materials or articles which he proposes to incorporate.
- (c) Machinery, mechanical and other equipment, materials or articles installed or used without such prior approval shall be at the risk of subsequent rejection.

- (d) Materials specified by reference to the number or symbol of a specific standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Invitation for Bids, except as limited to type, class or grade, or modified in the technical specifications shall have full force and effect as though printed therein.
- (e) The Owner may require the Contractor to dismiss from the work such employee or employees as the Owner or the Engineer may deem incompetent, or careless, or insubordinate.

16. Samples, Certificates and Tests

- (a) The Contractor shall submit all material or equipment samples, certificates, affidavits, etc., as called for in the contract documents or required by the Engineer, promptly after award of the contract and acceptance of the Contractor's bond. No such material or equipment shall be manufactured or delivered to the site, except at the Contractor's own risk, until the required samples or certificates have been approved in writing by the Engineer. Any delay in the work caused by late or improper submission of samples or certificates for approval shall not be considered just cause for an extension of the contract time.
- (b) Each sample submitted by the Contractor shall carry a label giving the name of the Contractor, the project for which it is intended, and the name of the producer. The accompanying certificate or letter from the Contractor shall state that the sample complies with contract requirements, shall give the name and brand of the product, its place of origin, the name and address of the producer and all specifications or other detailed information which will assist the Engineer in making a prompt decision regarding the acceptability of the sample. It shall also include the statement that all materials or equipment furnished for use in the project will comply with the samples and/or certified statements.
- (c) Approval of any materials shall be general only and shall not constitute a waiver of the Owner's right to demand full compliance with Contract requirements. After actual deliveries, the Engineer will have such check tests made as he deems necessary in each instance and may reject materials and equipment and accessories for cause, even though such materials and articles have been given general approval. If materials, equipment or accessories which fail to meet check tests have been incorporated in the work, the Engineer will have the right to cause their removal and replacement by proper materials or to demand and secure such reparation by the Contractor as is equitable.
- (d) Except as otherwise specifically stated in the Contract, the costs of sampling and testing will be divided as follows:
 - 1) The Contractor shall furnish without extra cost, including packing and delivery charges, all samples required for testing purposes, except those samples taken on the project by the Engineer;
 - 2) The Contractor shall assume all costs of re-testing materials which fail to meet contract requirements;
 - 3) The Contractor shall assume all costs of testing materials offered in substitution for those found deficient;
 - 4) The Owner will pay all other expenses.

17. Permits and Codes

- (a) The Contractor shall give all notices required by and comply with all applicable laws, ordinances, and codes of the Local Government. All construction work and/or utility installations shall comply with all applicable ordinances, and codes including all written waivers. Before installing any work, the

Contractor shall examine the drawings and technical specifications for compliance with applicable ordinances and codes and shall immediately report any discrepancy to the Owner. Where the requirements of the drawings and technical specifications fail to comply with such applicable ordinances or codes, the Owner will adjust the Contract by Change Order to conform to such ordinances or codes (unless waivers in writing covering the difference have been granted by the governing body or department) and make appropriate adjustment in the Contract Price or stipulated unit prices.

- (b) Should the Contractor fail to observe the foregoing provisions and proceed with the construction and/or install any utility at variance with any applicable ordinance or code, including any written waivers (notwithstanding the fact that such installation is in compliance with the drawings and technical specifications), the Contractor shall remove such work without cost to the Owner.
- (c) The Contractor shall at his own expense, secure and pay for all permits for street pavement, sidewalks, shed, removal of abandoned water taps, sealing of house connection drains, pavement cuts, buildings, electrical, plumbing, water, gas and sewer permits required by the local regulatory body or any of its agencies.
- (d) The Contractor shall comply with applicable local laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the Project Area and commit no trespass on any public or private property in any operation due to or connected with the Improvements contained in this Contract.
- (e) The Contractor will be required to make arrangements for and pay the water, electrical power, or any other utilities required during construction.
- (f) During construction of this project, the Contractor shall use every means possible to control the amount of dust created by construction. Prior to the close of a day's work, the Contractor, if directed by the Owner, shall moisten the bank and surrounding area to prevent a dusty condition.

18. Care of Work

- (a) The Contractor shall be responsible for all damages to person or property that occur as a result of his fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance.
- (b) The Contractor shall provide sufficient competent watchmen, both day and night, including Saturdays, Sundays, and holidays, from the time the work is commenced until final completion and acceptance.
- (c) In an emergency affecting the safety of life, limb or property, including adjoining property, the Contractor, without special instructions or authorization from the Owner is authorized to act at his discretion to prevent such threatened loss or injury, and he shall so act. He shall likewise act if instructed to do so by the Owner.
- (d) The Contractor shall avoid damage as a result of his operations to existing sidewalks, streets, curbs, pavements, utilities (except those which are to be replaced or removed), adjoining property, etc., and he shall at his own expense completely repair any damage thereto caused by his operations.
- (e) The Contractor shall shore up, brace, underpin, secure, and protect as maybe necessary, all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be in any way affected by the excavations or other operations connected with the construction of the improvements included in this Contract. The Contractor shall be responsible for the giving of any and all required notices to any adjoining or adjacent property owner or other party

before the commencement of any work. The Contractor shall indemnify and save harmless the Owner from any damages on account of settlements or the loss of lateral support of adjoining property and from all loss or expense and all damages for which the Owner may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

19. Accident Prevention

- (a) No laborer or mechanic employed in the performance of this Contract shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety as determined under construction safety and health standards promulgated by the Secretary of Labor.
- (b) The Contractor shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work.
- (c) The Contractor shall maintain an accurate record of all cases of death, occupational disease, or injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract. The Contractor shall promptly furnish the Owner with reports concerning these matters.
- (d) The Contractor shall indemnify and save harmless the Owner from any claims for damages resulting from property damage, personal injury and/or death suffered or alleged to have been suffered by any person as a result of any work conducted under this contract.
- (e) The Contractor shall provide trench safety for all excavations more than five feet deep prior to excavation. All OSHA Standards for trench safety must be adhered to by the Contractor.
- (f) The contractor shall at all times conduct his work in such a manner as to insure the least possible inconvenience to vehicular and pedestrian traffic. At the close of the work each day, all streets where possible in the opinion of the Owner, shall be opened to the public in order that persons living in the area may have access to their homes or businesses by the use of the streets. Barricades, warning signs, and necessary lighting shall be provided to the satisfaction of the Owner at the expense of the Contractor.

20. Sanitary Facilities

The Contractor shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe and fresh and served from single service containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing and governing health regulations.

21. Use of Premises

- (a) The Contractor shall confine his equipment, storage of materials, and construction operations to the contract limits as shown on the drawings and as prescribed by ordinances or permits, or as may be desired by the Owner, and shall not unreasonably encumber the site or public rights of way with his materials and construction equipment.
- (b) The Contractor shall comply with all reasonable instructions of the Owner and all existing state and local regulations regarding signs, advertising, traffic, fires, explosives, danger signals, and barricades.

22. Removal of Debris, Cleaning, Etc.

The Contractor shall, periodically or as directed during the progress of the work, remove and legally dispose of all surplus excavated material and debris, and keep the Project Area and public rights of way reasonably clear. Upon completion of the work, he shall remove all temporary construction facilities, debris and unused materials provided for work, and put the whole site of the work and public rights of way in a neat and clean condition.

23. Inspection

- (a) All materials and workmanship shall be subject to inspection, examination, or test by the Owner and Engineer at any and all times during manufacture or construction and at any and all places where such manufacture or construction occurs. The Owner shall have the right to reject defective material and workmanship or require its correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected material shall be promptly segregated and removed from the Project Area and replaced with material of specified quality without charge. If the Contractor fails to proceed at once with the correction of rejected workmanship or defective material, the Owner may by contract or otherwise have the defects remedied or rejected materials removed from the Project Area and charge the cost of the same against any Monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.
- (b) The Contractor shall furnish promptly all materials reasonably necessary for any tests which may be required. All tests by the Owner will be performed in such manner as not to delay the work unnecessarily and will be made in accordance with the provisions of the technical specifications.
- (c) The Contractor shall notify the Owner sufficiently in advance of back filling or concealing any facilities to permit proper inspection. If any facilities are concealed without approval or consent of the Owner, the Contractor shall uncover for inspection and recover such facilities at his own expense, when so requested by the Owner.
- (d) Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed by uncovering the same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any important or essential respect, due to fault of the Contractor or his subcontractors, the Contractor shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the actual cost of labor and material necessarily involved in the examination and replacement, shall be allowed the Contractor and he shall, in addition, if completion of the work of the entire Contract has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.
- (e) Inspection of materials and appurtenances to be incorporated in the improvements included in this Contract may be made at the place of production, manufacture or shipment, whenever the quantity justifies it, and such inspection and acceptance, unless otherwise stated in the technical specifications, shall be final, except as regards (1) latent defects, (2) departures from specific requirements of the Contract, (3) damage or loss in transit, or (4) fraud or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of materials as a whole or in part will be made at the Project Site.
- (f) Neither inspection, testing, approval nor acceptance of the work in whole or in part, by the Owner or its agents shall relieve the Contractor or his sureties of full responsibility for materials furnished or work performed not in strict accordance with the Contract.

24. Review by Owner

The Owner and its authorized representatives and agents shall have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material

invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the Contractor only by the Owner through its authorized representatives or agents.

25. Final Inspection

When the Improvements included in this Contract are substantially completed, the Contractor shall notify the Owner in writing that the work will be ready for final inspection on a definite date which shall be stated in the notice. The Owner will make the arrangements necessary to have final inspection commenced on the date stated in the notice, or as soon thereafter as is practicable.

26. Deduction for Uncorrected Work

If the Owner deems it not expedient to require the Contractor to correct work not done in accordance with the Contract Documents, an equitable deduction from the Contract Price will be made by agreement between the Contractor and the Owner and subject to settlement, in case of dispute, as herein provided.

27. Warranty of Title

No material, supplies, or equipment to be installed or furnished under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease-purchase or other agreement by which an interest is retained by the seller or supplier. The Contractor shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed by him to the Owner free from any claims, liens, or charges. Neither the Contractor nor any person, firm, or corporation furnishing any material or labor for any work covered by this Contract shall have any right to a lien upon any improvement or appurtenance. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any law permitting such persons to look to funds due the Contractor in the hands of the Owner. The provisions of this paragraph shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

28. Warranty of Workmanship and Materials

Neither the final certificate of payment nor any provision in the Contract nor partial or entire use of the improvements included in this Contract by the Owner or the public shall constitute an acceptance of work not done in accordance with the Contract or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall promptly remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within a period of 12 months from the date of final acceptance of the work.

29. Compliance with Air and Water Acts

(a) In compliance with the Clean Air Act, as amended, 41 U.S.C. Sec. 7401 et. seq., and the regulations of the Environmental Protection Agency with respect thereto, the Contractor agrees that:

- 1) Any facility to be utilized in the performance of this contract or any subcontract shall not be a facility listed on the EPA List of Violating Facilities pursuant to 40 CFR 15.20.
- 2) He will comply with all requirements of Section 114 of the Clean Air Act, as amended.
- 3) Materials utilized in the project shall be free of any hazardous materials, except as may be specifically provided for in the specifications.

(b) If the Contractor encounters existing material on sites owned or controlled by the Owner or in material sources that are suspected by visual observation or smell to contain hazardous materials, the Contractor shall immediately notify the Engineer and the Owner. The Owner will be responsible for testing for and removal or disposition of hazardous materials on sites owned or controlled by the Owner. The Owner may suspend the work, wholly or in part during the testing, removal or disposition of hazardous materials on sites owned or controlled by the Owner.

30. Section 109 of the Housing and Community Development Act of 1974

No person in the United States shall on the ground of race, color, national origin, or sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity funded in whole or in part with funds made available under this title.

31. The Provision of Local Training, Employment, and Business Opportunities

(a) To the greatest extent feasible opportunities for training and employment be given lower income residents of the project area and contracts for work in connection with the project be awarded to business concerns which are located in, or owned in substantial part by persons residing in the area of the project.

(b) The Contractor will include this clause in every subcontract for work in connection with the project.

32. Non Segregated Facilities

The Contractor certifies that he does not and will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not and will not permit his employees any segregated facilities at any of his establishments, or permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. As used in this paragraph the term "segregated facilities" means any waiting rooms, work areas, rest rooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise.

33. Job Offices

(a) The Contractor and his subcontractors may maintain such office and storage facilities on the site as are necessary for the proper conduct of the work. These shall be located so as to cause no interference to any work to be performed on the site. The Owner shall be consulted with regard to locations.

(b) Upon completion of the improvements, or as directed by the Owner, the Contractors shall remove all such temporary structures and facilities from the site, and leave the site of the work in the condition required by the Contract.

34. Partial Use of Site Improvements

The Owner may give notice to the Contractor and place in use those sections of the improvements which have been completed, inspected and can be accepted as complying with the technical specifications and if in its opinion, each such section is reasonably safe, fit, and convenient for the use and accommodation for which it was intended, provided:

(a) The use of such sections of the Improvements shall in no way impede the completion of the remainder of the work by the Contractor.

- (b) The Contractor shall not be responsible for any damages or maintenance costs due directly to the use of such sections.
- (c) The period of guarantee stipulated in the Section 29 hereof shall not begin to run until the date of the final acceptance of all work which the Contractor is required to construct under this Contract.

BID PROPOSAL

The bidder hereby proposes to furnish all labor, material, equipment and incidentals for:
San Leon MUD Motor Control Center

Enclosed is a Cashier's Check or Bid Bond in the sum of 5% of the greatest amount bid.

Bidder agrees to perform in accordance with the requirements of the contract documents in consideration of payment by the County of the prices in this proposal.

IN CASE OF DISCREPANCY BETWEEN UNIT PRICES AND EXTENDED PRICES, UNIT PRICES WILL GOVERN.

This bid sheet must be completely filled out in ink or typewritten with any necessary supplemental information attached.

The undersigned hereby agrees to all of the foregoing terms and provisions and to all terms and provisions of the contract, if awarded, which includes all provisions of this bid package.

BIDDER _____

SIGNATURE _____

PRINT NAME _____

TITLE _____

ADDRESS _____

CITY, STATE _____

ZIP _____

TELEPHONE _____

FAX NO _____

DATE _____

TAX I.D. No. _____

Item No.	Section No.	Item Description⁽⁴⁾	Unit	Unit Quantity	Unit Price⁽¹⁾	Total
General Items						
1	Div.16	Electrical System	LS	1	\$_____	\$_____
2	Div.1-10	Structural Mezzanine Floor	LS	1	\$_____	\$_____
		TOTAL BASE BID				\$_____

Subtotal General Items \$ _____

**TOTAL BASE BID
(SUM OF ITEMS ABOVE)** \$ _____

**Subtotal Extra Unit Price
Items** \$ _____ N/A

**TOTAL AMOUNT BID
BASE BID PLUS SUBTOTAL
EXTRA UNIT PRICE ITEMS** \$ _____

Notes:

- (1) In the event of a discrepancy, this column shall govern.
- (2) Fixed Price determined prior to Bid. Cannot be adjusted by the Bidder.
- (3) Minimum Bid Price determined prior to Bid. Can be increased by the Bidder by crossing out the Minimum and noting revised price on the line above.
- (4) The intent of the Contract Documents is for the Contractor to include all items necessary for the proper execution and completion of the Work described in the Contract Documents. No separate measurement and payment shall be made for any work unless identified as a pay item in the BID. Include the cost of work not identified as a separate pay item in Contract price bid for items of which this work is a component. In case of discrepancy between measurement and payment within the BID and Technical Specification Section, the BID shall govern.
- (5) Trenchless Construction is defined as any method other than open cut including methods that utilize primary tunnel liner or steel casing. Contractor shall determine, based on soil information, if a primary tunnel liner is required.

State of Texas Tax Statement of Materials and other charges:

The cost of in-place materials to be
incorporated into the project \$ _____

The cost of labor, profit, materials
not in-place and all other charges \$ _____

TOTAL: (Must agree with bid) \$ _____

CONTRACT AWARD

CONTRACT FOR: SAN LEON MUD MOTOR CONTROL CENTER

THIS CONTRACT IS ENTERED INTO BETWEEN GALVESTON COUNTY AND THE CONTRACTOR NAMED BELOW PURSUANT TO SUBCHAPTER B, CHAPTER 271, TEXAS LOCAL GOVERNMENT CODE, AND THE REFERENCED INVITATION TO BID.

Contract No: 18-1098

Bid No: _____

Contractor: _____

The Specifications and Drawings are enumerated as follows:

Standard Specifications: San Leon MUD Motor Control Ceneter Project Manual

Special Provisions: N/A

Special Items: N/A

DRAWINGS: SAN LEON MUD Motor Control Center Sheets 1 – 37
ADDENDA: _____

Contract Award (continued)

Invitation to Bid, General Provisions, Special Provisions for Construction, Bid Forms, Vendor Qualification Packet, Non-Collusion Affidavit, Bid Proposal, Affidavit and Surety Forms, Lobbying Certification, Labor Standards/Prevailing Wage Requirements, Contractor's Local Opportunity Plan, Statement of Bidder's Qualifications, Contractor Certifications, Section 504 Certification "Policy of Nondiscrimination on the Basis of Disability", Bid Bond, Payment Bond, Performance Bond and Attorney Certification, Disaster Recovery Projects, Texas General Land Office Forms, Specifications and Plans attached to this Contract Award are all made a part of this Contract and collectively evidence and constitute the entire contract. Contractor shall furnish all materials, perform all of the work required to be done and do everything else required by these documents.

Time of Completion: The Contractor shall complete the work within 180 Calendar Days of the issuance of the notice to proceed. The time set forth for completion of the work is an essential element of the Contract.

The Contract Sum: The County shall pay the Contractor for performance of the Contract, the sum of _____ Dollars and No/100 (\$_____), payments to be made as described herein.

Performance Bond required: (x) yes () no
Payment Bond required: (x) yes () no

This Contract is issued pursuant to award made by Commissioners' Court on _____, 20__.

EXECUTED this ____ day of _____, 20__.

COUNTY OF GALVESTON, TEXAS

BY: _____
MARK HENRY, County Judge

ATTEST:

DWIGHT SULLIVAN, County Clerk

CONTRACTOR

BY: _____
Signature

Printed Name - Title

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

TO (Owner):

PROJECT NO:

PROJECT:
(name, address)

CONTRACT FOR:

CONTRACT DATE:

CONTRACTOR:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(here insert name and address of Surety as it appears in the bond).

, SURETY COMPANY,

on bond of (here insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety
Company of any of its obligations to (here insert name and address of Owner)

, OWNER,

as set forth in the said Surety Company's bond.

IN WITNESS WHEREOF,
the Surety Company has hereunto set its had this

day of _____ 20__ .

Surety Company

Signature of Authorized Representative

Title

ATTEST:
(Seal):

NOTE: This form is to be use as a companion document to Contractor's Affidavit of Payment of Debts and Claims.

CONSENT OF SURETY TO REDUCTION IN OR PARTIAL RELEASE OF RETAINAGE

TO (Owner):

PROJECT NO:

PROJECT:
(name, address)

CONTRACT FOR:

CONTRACT DATE:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(here insert name and address of Surety as it appears in the bond).

, SURETY,

on bond of (here insert name and address of Contractor as it appears in the bond)

, CONTRACTOR,

hereby approves the reduction in or partial release of retainage to the contractor as follows:

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its
obligations to (here insert name and address of Owner)

, OWNER,

as set forth in the said Surety's bond.

IN WITNESS WHEREOF,
the Surety has hereunto set its had this

day of

20 .

Surety

Signature of Authorized Representative

Title

ATTEST:
(Seal):

CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

TO (Owner):

PROJECT NO:

CONTRACT FOR:

PROJECT:
(name, address)

CONTRACT DATE:

State of:

County of:

The undersigned, hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or his property might in any way be held responsible.

EXCEPTIONS: (If none, write "None". If required by the Owner, the Contractor shall furnish bond satisfactory to the Owner for each exception.)

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment.
Whenever Surety is involved, consent of Surety is required. CONSENT OF SURETY, may be used for this purpose.
Indicate attachment: yes _____ no _____

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens.

CONTRACTOR:

Address:

BY:

Subscribed and sworn to before me this

day of _____ 20

Notary Public:

My Commission Expires:

CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

TO (Owner):

PROJECT NO:

CONTRACT FOR:

PROJECT:
(name, address)

CONTRACT DATE:

State of:

County of:

The undersigned, hereby certifies that, to the best of his knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS: (If none, write "None". If required by the Owner, the Contractor shall furnish bond satisfactory to the Owner for each exception.)

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Sub-contractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR:

Address:

BY:

Subscribed and sworn to before me this

day of _____ 20

Notary Public:

My Commission Expires:

Federal Labor Standards Provisions

U.S. Department of Housing
And Urban Development

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

A. 1. (i) Minimum Wages. All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR Part 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(a) Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage rate and fringe benefits therefore only when the following criteria have been met.

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140).

(c) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140).

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(b) or (c) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of an laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140).

2. Withholding. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract, in the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, HUD or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the contractor, disburse such amounts withheld for and on account of the contractor disburse such amounts withheld for and on account of the contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

3. (i) Payrolls and basic records. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates or contributions or costs anticipated for bona fide fringe benefits or cash equivalents there of the types described in Section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017).

(ii)(a) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR Part 5.5(a)(3)(i). This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-0014-1), U. S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149).

(b) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be maintained under 29 CFR Part 5.5(a)(3)(i) and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph A.3.(ii)(b) of this section.

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph A.3.(i) of this section available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance,

or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR Part 5.12.

(4) Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration. Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor will insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as HUD or its designee may be appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause

include disputes between the contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1010, Title 18, U.S.C., "Federal Housing Administration transactions", provides in part "Whoever, for the purpose of ... influencing in any way the action of such Administration... makes, utters or publishes any statement, knowing the same to be false... shall be fined not more than \$5,000 or imprisoned not more than two years, or both."

11. Complaints, Proceedings, or Testimony by Employees. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

B. Contract Work Hours and Safety Standards Act. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (1) of this paragraph, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of eight hours or in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in subparagraph (1) of this paragraph.

(3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (1) through (4) of this paragraph.

C. Health and Safety

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 (formerly part 1518) and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (Public Law 91-54, 83 Stat.96).

(3) The Contractor shall include the provisions of this Article in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontract as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

Title 29 - LABOR

Subtitle A - Office of The Secretary of Labor

**PART 3 - CONTRACTORS AND SUBCONTRACTORS ON PUBLIC BUILDING OR PUBLIC WORK
FINANCED IN WHOLE OR IN PART BY LOANS OR GRANTS FROM THE UNITED STATES**

- ✓ Sec.
- ✓ 3.1 Purpose and scope
- 3.2 Definitions
 - ✓ 3.3 Weekly statement with respect to payment of wages
- 3.4 Submission of weekly statements and the preservation and inspection of weekly payroll records.
- ✓ 3.5 Payroll deductions permissible without application to or approval of the Secretary of Labor.
- ✓ 3.6 Payroll deductions permissible with the approval of the Secretary of Labor.
- ✓ 3.7 Applications for the approval of the Secretary of Labor
- ✓ 3.8 Action by the Secretary of Labor upon applications.
- ✓ 3.9 Prohibited payroll deductions.
- 3.10 Methods of payment of wages.
- 3.11 Regulations part of contract.

AUTHORITY: The provisions of this Part 3 issued under R.S. 161, sec. 2, 48 Stat. §48; Reorg. Plan No. 14 of 1950, 64 Stat. 1267, 5 U.S.C. Appendix; 5 U.S.C. 301; 40 U.S.C. 276c.

SOURCE: The provisions of this Part 13 appear at 29 F.R. 97, Jan. 4, 1964, unless otherwise noted.

Section 3.1 Purpose and Scope

This part prescribes "anti-kickback" regulations under section 2 of the Act of June 13, 1934, as amended (40 U.S.C. 276c), popularly known as the Copeland Act. This part applies to any contract which is subject to Federal wage standards and which is for the construction, prosecution, completion, or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States. The part is intended to aid in the enforcement of the minimum wage provisions of the Davis-Bacon Act and the various statutes dealing with Federally-assisted construction that contain similar minimum wage provisions, including those provisions which are not subject to Reorganization Plan No. 14 (e.g., the College Housing Act of 1950, the Federal Water Pollution Control Act, and the Housing Act of 1959), and in the enforcement of the overtime provisions of the Contract Work Hours Standards Act whenever they are applicable to construction work. The part details the obligation of contractors and subcontractors relative to the weekly submission of statements regarding the wages paid on work covered thereby; sets forth the circumstances and procedures governing the making of payroll deductions from the wages of those employed on such work; and delineates the methods of payment permissible on such work.

Section 3.2 Definitions.

As used in the regulations in this part:

(a) The terms "building" or "work" generally include construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The terms include, without limitation, buildings, structures, and improvements of all types, such as bridges) dams, plants) highways, parkways, streets) subways, tunnels, sewers, mains, power lines, pumping stations, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals; dredging, shoring, scaffolding, drilling, blasting, excavating, clearing and landscaping. Unless conducted in connection with and at the site of such a building or work as is described in the foregoing *sentence*, the manufacture or furnishing of materials, articles, supplies, or equipment (whether or not a Federal or State agency acquires title to such materials, articles, supplies, or equipment during the course of the manufacture or furnishing, or owns the materials from which

they are manufactured or furnished) is not a "building" or "work" within the meaning of the regulations in this part.

(b) The terms "construction," "prosecution," "completion," or "repair" mean all types of work done on a particular building or work at the site thereof, including, without limitation, altering, remodeling, painting and decorating, the transporting of materials and supplies to or from the building or work by the employees of the construction contractor or construction subcontractor, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work, by persons employed at the site by the contractor or subcontractor.

(c) The terms "public building" or "public work" include building or work for whose construction, prosecution, completion, or repair, as defined above, a Federal agency is a contracting party, regardless of whether title thereof is in a Federal agency.

(d) The term "building or work financed in whole or in part by loans or grants from the United States" includes building or work for whose construction, prosecution, completion, or repair, as defined above, payment or part payment is made directly or indirectly from funds provided by loans or grants by a Federal agency. The term includes building or work for which the Federal assistance granted is in the form of loan guarantees or insurance.

(e) Every person paid by a contractor or subcontractor in any manner for his labor in the construction, prosecution, completion, or repair of a public building or public work or building or work financed in whole or in part by loans or grants from the United States is "employed" and receiving "wages," regardless of any contractual relationship alleged to exist between him and the real employer.

(f) The term "any affiliated person" includes a spouse, child, parent, or other close relative of the contractor or subcontractor; a partner or officer of the contractor or subcontractor; a corporation closely connected with the contractor or subcontractor as parent, subsidiary or otherwise, and an officer or agent of such corporation.

(g) The term "Federal agency" means the United States, the District of Columbia, and all executive departments, independent establishments, administrative agencies, and instrumentalities of the United States and of the District of Columbia, including corporations, all or substantially all of the stock of which is beneficially owned by the United States, by the District of Columbia, or any of the foregoing departments, establishments, agencies, and instrumentalities.

{29 FR 97, Jan. 4, 1964, as amended at 33 FR 32575, Nov. 27, 1973}

Section 3.3 Weekly statement with respect to payment of wages.

(a) As used in this section, the term "employee" shall not apply to persons in classifications higher than that of laborer or mechanic and those who are the immediate supervisors of such employees.

(b) Each contractor or subcontractor engaged in the construction, prosecution, completion, or repair of any public building or public work, or building or work financed in whole or in part by loans or grants from the United States) shall furnish each week a statement with respect to the wages paid each of its employees engaged on work covered by 29 CFR Parts 3 and 5 during the preceding weekly payroll period. This statement shall be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, and shall be on form WH 348, "Statement of Compliance," or on an identical form on the back of WH 347, "Payroll (For Contractors Optional Use)" or on any form with identical wording. Sample copies of WH 347 and WH 348 may be obtained from the Government contracting or sponsoring agency, and copies of these forms may be purchased at the Government Printing Office.

(c) The requirements of this section shall not apply to any contract of \$2,000 or less.

(d) Upon a written finding by the head of a Federal agency, the Secretary of Labor may provide reasonable limitations, variations, tolerances, and exemptions from the requirements of this section subject to such conditions as the Secretary of Labor may specify.

{29 F.R. 95, Jan. 4, 1964, as amended at 33 FR. 10186, July 17, 1968}

Section 3.4 Submission of weekly statements and the preservation and inspection of weekly payroll records.

(a) Each weekly statement required under §3.3 shall be delivered by the contractor or subcontractor, within seven days after the regular payment date of the payroll period, to a representative of a Federal or State agency in charge at the site of the building or work, or if there is no representative of a Federal or State agency at the site of the building or work, the statement shall be mailed by the contractor or subcontractor, within such time, to a Federal or State agency contracting for or financing the building or work. After such examination and check as may be made, such statement, or a copy thereof, shall be kept available, or shall be transmitted together with a report of any violation, in accordance with applicable procedures prescribed by the United States Department of Labor.

(b) Each contractor or subcontractor shall preserve his weekly payroll records for a period of three years from date of completion of the contract. The payroll records shall set out accurately and completely the name and address of each laborer and mechanic, his correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual

wages paid. Such payroll records shall be made available at all times for inspection by the contracting officer or his authorized representative, and by authorized representatives of the Department of Labor.

Section 3.5 Payroll deductions permissible without application to or approval of the Secretary of Labor.

Deductions made under the circumstances or in the situations described in the paragraphs of this section may be made without application to and approval of the Secretary of Labor:

(a) Any deduction made in compliance with the requirements of Federal, State, or local law, such as Federal or State withholding income taxes and Federal social security taxes.

(b) Any deduction of sums previously paid to the employee as a bona fide prepayment of wages when such prepayment is made without discount or interest. A "bona fide prepayment of wages" is considered to have been made only when cash or its equivalent has been advanced to the person employed in such manner as to give him complete freedom of disposition of the advanced funds.

(c) Any deduction of amounts required by court process to be paid to another, unless, the deduction is in favor of the contractor, subcontractor or any affiliated person, or when collusion or collaboration exists.

(d) Any deduction constituting a contribution on behalf of the person employed to funds established by the employer or representatives of employees, or both, for the purpose of providing either from principal or income, or both, medical or hospital care, pensions, or annuities on retirement, death benefits, compensation for injuries, illness, accidents, sickness, or disability, or for insurance to provide any of the foregoing, or unemployment benefits, vacation pay, savings accounts, or similar payments for the benefit of employees, their families and dependents: Provided, however, That the following standards are met: (1) The deduction is not otherwise prohibited by law; (2) it is either: (i) Voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of or for the continuation of employment, or

(ii) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees; (3) no profit or other benefit is otherwise obtained, directly or indirectly, by the contractor or subcontractor or any affiliated person in the form of commission, dividend, or otherwise; and (4) the deductions shall serve the convenience and interest of the employee.

(e) Any deduction contributing toward the purchase of United States Defense Stamps and Bonds when voluntarily authorized by the employee.

(f) Any deduction requested by the employee to enable him to re]lay loans to or to purchase shares in. credit unions organized and operated in accordance with Federal and State credit union statutes.

(g) Any deduction voluntarily authorized by the employee for the making of contributions to governmental or quasi-governmental agencies, such as the American Red Cross.

(h) Any deduction voluntarily authorized by the employee for the making of contributions to Community Chests, United Givers Funds, and similar charitable organizations.

(i) Any deductions to pay regular union initiation fees and membership dues, not including fines or special assessments: Provided, however, that a collective bargaining agreement between the contractor or subcontractor and representatives of its employees provides for such deductions and the deductions are not otherwise prohibited by law.

(j) Any deduction not more than for the "reasonable cost" of board, lodging, or other facilities meeting the requirements of section 3(m) of the Fair Labor Standards Act of 1938, as amended, and Part 531 of this title. When such a deduction is made the additional records required under §516.27(a) of this title shall be kept.

(k) Any deduction for the cost of safety equipment of nominal value purchased by the employee as his own property for his personal protection in his work, such as safety shoes, safety glasses, safety gloves, and hard hats, if such equipment is not required by law to be furnished by the employer, if such deduction is not violative of the Fair Labor Standards Act or prohibited by other law, if the cost on which the deduction is based does not exceed the actual cost to the employer where the equipment is purchased from him and does not include any direct or indirect monetary return to the employer where the equipment is purchased from a third person, and if the deduction is either (1) voluntarily consented to be the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance; or (2) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees.

{36F.R. 9770, May 28, 1971.}

Section 3.6 Payroll deductions permissible with the approval of the Secretary of Labor.

Any contractor or subcontractor may apply to the Secretary of Labor for permission to make any deduction not permitted

under §3 .5. The Secretary may grant permission whenever he finds that:

- (a) The contractor, subcontractor, or any affiliated person does not make a profit or benefit directly or indirectly from the deduction either in the form of a commission, dividend, or otherwise;
- (b) The deduction is not otherwise prohibited by law;
- (c) The deduction is either (1) voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance, or (2) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees; and
- (d) The deduction serves the convenience and interest of the employee.

Section 3.7 Applications for the approval of the Secretary of Labor.

Any application for the making of payroll deductions under §3.6 shall comply with the requirements prescribed in the following paragraphs of this section:

- (a) The application shall be in writing and shall be addressed to the Secretary of Labor.
- (b) The application need not identify the contract or contracts under which the work in question is to be performed. Permission will be given for deductions on all current and future contracts of the applicant for a period of 1 year. A renewal of permission to make such payroll deduction will be granted upon the submission of an application which makes reference to the original application, recites the date of the Secretary of Labor's approval of such deductions) states affirmatively that there is continued compliance with the standards set forth in the provisions of §3 .6, and specifies any conditions which have changed in regard to the payroll deductions.
{36 F.R. 9770, May 28, 1971.}
- (c) The application shall state affirmatively that there is compliance with the standards set forth in the provisions of §3.6. The affirmation shall be accompanied by a full statement of the facts indicating such compliance.
- (d) The application shall include a description of the proposed deduction, the purpose to be served thereby, and the classes of laborers or mechanics from whose wages the proposed deduction would be made,
- (e) The application shall state the name and business of any third person to whom any funds obtained from the proposed deductions are to be transmitted and the affiliation of such person, if any, with the applicant.

Section 3.8 Action by the Secretary of Labor upon applications.

The Secretary of Labor shall decide whether or not the requested deduction is permissible under provisions of §3.6; and shall notify the applicant in writing of his decision.

Section 3.9 Prohibited payroll deductions.

Deductions not elsewhere provided for by this part and which are not found to be permissible under §3.6 are prohibited.

Section 3.10 Methods of payment of wages.

The payment of wages shall be by cash, negotiable instruments payable on demand, or the additional forms of compensation for which deductions are permissible under this part. No other methods of payment shall be recognized on work subject to the Copeland Act.

Section 3.11 Regulations part of contract.

All contracts made with respect to the construction, prosecution, completion, or repair of any public building or public work or building or work financed in whole or in part by loans or grants from the United States covered by the regulations in this part shall expressly bind the contractor or subcontractor to comply with such of the regulations in this part as may be applicable. In this regard, see §5.5(a) of this subtitle.

General Decision Number: TX180298 01/12/2018 TX298

Superseded General Decision Number: TX20170298

State: Texas

Construction Type: Building

County: Galveston County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.35 for calendar year 2018 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.35 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2018. The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2018
1	01/12/2018

ASBE0022-009 06/01/2017

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation).....	\$ 23.26	12.92

BOIL0074-003 01/01/2017

	Rates	Fringes
BOILERMAKER.....	\$ 28.00	22.35

CARP0551-011 04/01/2016

	Rates	Fringes
CARPENTER (Excludes Acoustical Ceiling Installation, Drywall Finishing/Taping, Drywall Hanging, Form Work and Metal Stud Installation).....	\$ 23.05	8.78

* ELECO527-002 01/01/2018

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Rates Finges

ELECTRICIAN (Excludes Low Voltage Wiring and Installation of Alarms)..... \$ 28.19 3% + 10.42

* ELEVO031-003 01/01/2018

Rates Finges

ELEVATOR MECHANIC..... \$ 41.28 32.645+a+b

FOOTNOTES:

A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.

B. Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day; and Veterans Day.

ENGI0450-002 04/01/2014

Rates Finges

POWER EQUIPMENT OPERATOR
Cranes..... \$ 34.85 9.85

IRON0084-011 06/01/2017

Rates Finges

IRONWORKER, ORNAMENTAL..... \$ 23.27 7.12

PAI N0130-002 06/01/2017

Rates Finges

PAINTER (Brush, Roller, and Drywall Finishing/Taping)..... \$ 17.60 8.91

PLAS0079-004 01/01/2015

Rates Finges

PLASTERER..... \$ 19.92 1.00

PLUM0068-002 10/01/2017

Rates Finges

PLUMBER..... \$ 34.90 10.54

PLUM0211-010 10/01/2017

Rates Finges

PIPEFITTER (Including HVAC Pipe Installation)..... \$ 34.10 11.71

SHEE0054-012 07/01/2017

SHEET METAL WORKER

Excludes HVAC Duct and Unit Installation.....	\$ 27.72	13.70
HVAC Duct Installation Only.	\$ 27.72	13.70

SUTX2014-024 07/21/2014

	Rates	Fri nges
ACOUSTICAL CEILING MECHANIC.....	\$ 16.41	3.98
BRICKLAYER.....	\$ 19.86	0.00
CAULKER.....	\$ 15.36	0.00
CEMENT MASON/CONCRETE FINISHER...	\$ 13.82	0.00
DRYWALL HANGER AND METAL STUD INSTALLER.....	\$ 17.88	5.24
ELECTRICIAN (Alarm Installation Only).....	\$ 17.97	3.37
ELECTRICIAN (Low Voltage Wiring Only).....	\$ 19.23	3.55
FLOOR LAYER: Carpet.....	\$ 20.00	0.00
FORM WORKER.....	\$ 12.07	0.00
GLAZIER.....	\$ 17.09	3.41
HVAC MECHANIC (Installation of HVAC Unit Only).....	\$ 17.40	0.00
IRONWORKER, REINFORCING.....	\$ 12.10	0.00
IRONWORKER, STRUCTURAL.....	\$ 25.37	6.00
LABORER: Common or General.....	\$ 11.47	0.00
LABORER: Mason Tender - Brick...	\$ 13.37	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 10.50	0.00
LABORER: Pipelayer.....	\$ 12.94	0.00
LABORER: Roof Tearoff.....	\$ 11.28	0.00
LABORER: Landscape and Irrigation.....	\$ 9.49	0.00
LATHER.....	\$ 20.11	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 14.10	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 13.93	0.00

OPERATOR: Bulldozer.....	\$ 20.77	0.00
OPERATOR: Drill.....	\$ 16.22	0.34
OPERATOR: Forklift.....	\$ 15.64	0.00
OPERATOR: Grader/Blade.....	\$ 13.37	0.00
OPERATOR: Loader.....	\$ 13.55	0.94
OPERATOR: Mechanic.....	\$ 17.52	3.33
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 16.03	0.00
OPERATOR: Roller.....	\$ 16.00	0.00
PAINTER: Spray (Excludes Drywall Finishing/Taping).....	\$ 17.43	4.43
ROOFER.....	\$ 15.40	0.00
SPRINKLER FITTER (Fire Sprinklers).....	\$ 18.62	3.03
TILE FINISHER.....	\$ 12.00	0.00
TILE SETTER.....	\$ 16.17	0.00
TRUCK DRIVER: 1/Single Axle Truck.....	\$ 14.95	5.23
TRUCK DRIVER: Dump Truck.....	\$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck.....	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 12.50	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.00	4.11
WATERPROOFER.....	\$ 14.39	0.00

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any
solicitation was issued) on or after January 1, 2017. If this
contract is covered by the EO, the contractor must provide
employees with 1 hour of paid sick leave for every 30 hours
they work, up to 56 hours of paid sick leave each year.
Employees must be permitted to use paid sick leave for their
own illness, injury or other health-related needs, including
preventive care; to assist a family member (or person who is
like family to the employee) who is ill, injured, or has other
health-related needs, including preventive care; or for reasons
resulting from, or to assist a family member (or person who is
like family to the employee) who is a victim of, domestic

violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

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3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

CONTRACTOR'S LOCAL OPPORTUNITY PLAN

_____ agrees to implement the following specific affirmative action steps directed at increasing the utilization of lower income residents and businesses within the County of Galveston.

- A. To ascertain from the Grant Recipient's CDBG program official the exact boundaries of the project area and where advantageous, seek the assistance of local officials in preparing and implementing the affirmative action plan.
- B. To attempt to recruit from within the city the necessary number of lower income residents through: local advertising media, signs placed at the proposed site for the project, and community organizations and public or private institutions operating within and servicing the project area such as Service Employment and Redevelopment (SER), Opportunities Industrialization Center (OIC), Urban League, Concentrated Employment Program, Hometown Plan, or the U.S. Employment Service.
- C. To maintain a list of all lower income residents who have applied either on their own or on referral from any source, and to employ such persons, if otherwise eligible and if a vacancy exists.
- D. To insert this plan in all bid documents and to require all bidders on subcontracts to submit an affirmative action plan including utilization goals and the specific steps planned to accomplish these goals.
- E. To insure that subcontracts (greater than \$10,000), which are typically let on a negotiated rather than a bid basis in areas other than the covered project area, are also let on a negotiated basis, whenever feasible, in a covered project area.
- F. To formally contact unions, subcontractors, and trade associations to secure their cooperation in this effort.
- G. To insure that all appropriate project area business concerns are notified of pending sub-contractual opportunities.
- H. To maintain records, including copies of correspondence, memoranda, etc., which document that all of the above affirmative action steps have been taken.
- I. To appoint or recruit an executive official of the company or agency as Equal Opportunity Officer to coordinate the implementation of this plan.
- J. To maintain records concerning the amount and number of contracts, subcontracts, and purchases which contribute to objectives.
- K. To maintain records of all projected work force needs for all phases of the project by occupation, trade, skill level, and number of positions and to update these projections based on the extent to which hiring meets these Local Opportunity objectives.

As officers and representatives of _____, we the undersigned have read and fully agree to this Plan, and become a party to the full implementation of the program and its provisions.

Signature

Title

Date

PROPOSED CONTRACTS BREAKDOWN

Type of Contracts	No. of Contracts	Approx. Total Dollar Amount	Estimated No. to local Business	Estimated \$ Amount Local Business

ESTIMATED PROJECT WORKFORCE BREAKDOWN

Work Classifications	Total Estimated Positions	No. of Positions Currently Filled	No. of Positions not Filled	No. of Positions to fill with L/M Residents
Totals				

STATEMENT OF BIDDER'S QUALIFICATIONS

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

Name of Bidder: _____ Date Organized: _____

Address: _____ Date Incorporated _____

Number of Years in contracting business under present name _____:

CONTRACTS ON HAND:

Contract	Amount \$	Completion Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

Type of work performed by your company: _____

Have you ever failed to complete any work awarded to you? _____

Have you ever defaulted on a contract? _____

List the projects most recently completed by your firm (include project of similar importance):

Project	Amount \$	Mo/Yr Completed
_____	_____	_____
_____	_____	_____
_____	_____	_____

Major equipment available for **this** contract: _____

Attach resume(s) for the principal member(s) of your organization, including the officers as well as the proposed superintendent for the project.

Credit available: \$ _____ Bank reference: _____

The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the _____ in verification of the recitals comprising this Statement of Bidder's Qualifications.

Executed this _____ day of _____, 20____.

By:(signature) _____ Title: _____

(print name) _____

CONTRACTOR CERTIFICATIONS

U.S. Department of Housing and Urban Development	
CERTIFICATION OF BIDDER REGARDING CIVIL RIGHTS LAWS AND REGULATIONS	
INSTRUCTIONS	
CERTIFICATION OF BIDDER REGARDING Executive Order 11246 and Federal Laws Requiring Federal Contractor to adopt and abide by equal employment opportunity and affirmative action in their hiring, firing, and promotion practices. This includes practices related to race, color, gender, religion, national origin, disability, and veterans' rights.	
NAME AND ADDRESS OF BIDDER (include ZIP Code)	
CERTIFICATION BY BIDDER	
Bidder has participated in a previous contract or subcontract subject to Civil Rights Laws and Regulations. <input type="checkbox"/> Yes <input type="checkbox"/> No	
The undersigned hereby certifies that: <input type="checkbox"/> The <u>Provision of Local Training, Employment, and Business Opportunities</u> clause (Section 3 provision) is included in the Contract. A written Section 3 plan (Local Opportunity Plan) was prepared and submitted as part of the bid proceedings (if bid equals or exceeds \$100,000). <input type="checkbox"/> The <u>Non Segregated Facilities</u> clause (Section 109 provision) is included in the Contract. No segregated facilities will be maintained as required by Title VI of the Civil Rights Act of 1964. <input type="checkbox"/> The <u>Equal Employment Opportunity</u> clause is included in the Contract (if bid equals or exceeds \$10,000). <input type="checkbox"/> The <u>Affirmative Action for Handicapped Workers</u> clause is included in the contract.	
Have you ever been or are you being considered for sanction due to violation of Executive Order 11246, as amended? <input type="checkbox"/> Yes <input type="checkbox"/> No	
NAME AND TITLE OF SIGNER (Please type)	
SIGNATURE	DATE

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
 COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM
 CONTRACTOR'S CERTIFICATION

CONCERNING LABOR STANDARDS AND PREVAILING WAGE REQUIREMENTS

TO (appropriate recipient)	DATE
C/O	PROJECT NUMBER (if any)
	PROJECT NAME

1. The undersigned, having executed a contract with _____
 _____ for the construction of the above-identified project, acknowledges that:

- (a) The Labor Standards provisions are included in the aforesaid contract,
- (b) Correction of any infractions of the aforesaid conditions, including infractions by any of his subcontractors and any lower tier subcontractors, is his responsibility.

2. He certifies that:

- (a) Neither he nor any firm, partnership or association in which he has substantial interest is designated as an ineligible contractor by the Comptroller General of the United States pursuant to Section 5.6(b) of the Regulations of the Secretary of Labor, Part 5 (29 CFR, Part 5) or pursuant to Section 3(a) of the Davis-Bacon Act, as amended.
- (b) No part of the aforementioned contract has been or will be subcontracted to any subcontractor if such subcontractor or any firm, corporation, partnership or association in which such subcontractor has a substantial interest is designated as an ineligible contractor pursuant to any of the aforementioned regulatory or statutory provisions.

3. He agrees to obtain and forward to the aforementioned recipient within ten days after the execution of any subcontract, including those executed by his subcontractors and any lower tier subcontractors, a Subcontractor's Certification Concerning Labor Standards and Prevailing Wage Requirements executed by the subcontractors.

4. He certifies that:

- (a) The legal name and the business address of the undersigned are:

(b) The undersigned is:

(1) A SINGLE PROPRIETORSHIP	(3) A CORPORATION ORGANIZED IN THE STATE OF
(2) A PARTNERSHIP	(4) OTHER ORGANIZATION (Describe)

(c) The name, title and address of the owner, partners or officers of the undersigned are:

NAME	TITLE	ADDRESS

(d) The names and addresses of all other persons having a substantial interest in the undersigned, and the nature of the interest are:

NAME	ADDRESS	NATURE OF INTEREST

(e) The names, addresses and trade classifications of all other building construction contractors in which the undersigned has a substantial interest are:

NAME	ADDRESS	TRADE CLASSIFICATION

Date _____

(Contractor)

By _____



Equal Opportunity Guidelines for Construction Contractors

- 1. What are the responsibilities of the offeror or bidder to insure EEO?**
The offeror or bidder must comply with the "Equal Opportunity Clause" and the "Standard Federal Equal Opportunity Construction Contract Specifications."
- 2. Are construction contractors required to insure a comfortable working environment for all employees?**
Yes, it is the construction contractor's responsibility to provide an environment free of harassment, intimidation, and coercion to all employees and to notify all foremen and supervisors to carry out this obligation, with specific attention to minority or female individuals.
- 3. To alleviate developing separate facilities for men and women on all sites, can a construction contractor place all women employees on one site?**
No, two or more women should be assigned to each site when possible.
- 4. Are construction contractors required to make special outreach efforts to Section 3 or minority and female recruitment sources?**
Yes, construction contractors must establish a current list of Section 3, minority and female recruitment sources. Notification of employment opportunities, including the availability of on-the-job training and apprenticeship programs, should be given to these sources. The efforts of the construction contractors should be kept in file.
- 5. Should records be maintained on the number of Section 3 residents, minority, and females applying for positions with construction contractors?**
Yes, records must be maintained to include a current list of names, addresses and telephone numbers of all Section 3, minority and female applicants. The documentation should also include the results of the applications submitted.
- 6. What happens if a woman or minority is sent to the union by the Contractor and is not referred back to the Contractor for employment?**
If the unions impede the construction contractor's responsibility to provide equal employment opportunity, a written notice should be submitted to TXCDBG.
- 7. What efforts are made by construction contractors to create entry-level positions for Section 3 residents, women and minorities?**
Construction contractors are required to develop on-the-job training programs, or participate in training programs, especially those funded by the Department of Labor, to create positions for Section 3 residents, women, and minorities and to meet employment needs.

- 8. Are any efforts made by the Contractor to publicize their EEO policy?**
Yes, the construction contractor is responsible for notifying unions and sources of training programs of their equal employment opportunity policy. Unions should be requested to cooperate in the effort of equal opportunity. The policy should be included in any appropriate manuals, or collective bargaining agreements. The construction contractor is encouraged to publicize the equal employment opportunity policy in the company newspaper and annual report. The Contractor is also responsible to include the EEO policy in all media advertisement.
- 9. Are any in-service training programs provided for staff to update the EEO policy?**
At least annually, a review of the EEO policy and the affirmative action obligations are required of all personnel employees of a decision-making status. A record of the meeting including date, time, location, persons present, subject matter discussed, and disposition of the subject matter should be maintained.
- 10. What recruitment efforts are made for Section 3 residents, minorities and women?**
The construction contractor must notify, both orally and in writing, Section 3, minority, and female recruitment sources one month prior to the date of acceptance for apprenticeship or other training programs.
- 11. Are any measures taken to encourage promotions for minorities and women?**
Yes, an annual evaluation should be conducted for all minority and female personnel to encourage these employees to seek higher positions.
- 12. What efforts are taken to insure that personnel policies are in accordance with the EEO policy?**
Personnel policies in regard to job practices, work assignments, etc. should be continually monitored to insure that the EEO policy is carried out.
- 13. Can women be excluded from utilizing any facilities available to men?**
No, all facilities and company activities are non-segregated except for bathrooms or changing facilities to insure privacy.
- 14. What efforts are made to utilize minority and female contractors and suppliers?**
None, however, records are kept of all offers to minority and female construction contractors.
- 15. If a construction contractor participates in a business related association that does not comply with affirmative action standards, does that show his/her failure to comply?**
No, the construction contractor is responsible for their own compliance.
- 16. Will a construction contractor be in violation of EEO policy and affirmative action if he sets up one set of goals to include minorities and women?**
Yes. There is a separate goal for minorities and a separate single goal for women. The construction contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women both minority and non-minority.
- 17. Can a construction contractor hire a subcontractor who has been debarred from government contracts pursuant to EEO?**
No. The construction contractor must suspend, terminate, or cancel its contract with any Subcontractor who is in violation of the EEO policy.
- 18. What effort has been taken by the construction contractor to monitor all employment to insure the company EEO policy is being carried out?**

March 1, 2013

The construction contractor must designate a responsible individual to keep accurate records of all employees that includes specific information required by the government.

SECTION 504 CERTIFICATION

**POLICY OF NONDISCRIMINATION ON THE BASIS
OF DISABILITY**

The _____ does not discriminate on the basis of disability in the admission or access to, or treatment or employment in, its federally assisted programs or activities.

(Name) _____

(Address) _____

City State Zip

Telephone Number () _____ - _____ Voice

() _____ - _____ TDD

has been designated to coordinate compliance with the nondiscrimination requirements contained in the Department of Housing and Urban Development's (HUD) regulations implementing Section 504 (24 CFR Part 8. dated June 2, 1988).

BID BOND

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

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the Accompanying Bid, dated _____, for _____

NOW, THEREFOR, if the Principal shall not withdraw said Bid within the period specified therein after the opening of the same, or, if no period be specified, within thirty (30) days after the said opening, and shall within the period specified therefor, or if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the Owner in accordance with the Bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract; or in the event of the withdrawal of said Bid within the period specified, or the failure to enter into such Contract and give such bond within the time specified, if the Principal shall pay the Owner the difference between the amount specified in said Bid and the amount for which the local Public Agency may procure the required work or supplies or both, if the latter be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS THEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, the name and corporate seal of each corporate party being hereto affixed and these present signed by its undersigned representative, pursuant to authority of its governing body.

(SEAL)

(SEAL)

Attest:

By: _____

Affix
Corporate
Seal

Attest:

By: _____

Affix
Corporate
Seal

Attest:

By: _____

Countersigned

By _____

* Attorney-in-Fact, State of _____

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____, Secretary of the Corporation named as Principal in the within bond; that _____, who signed the said bond on behalf of the Principal was then _____ of said corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed, and attested to, for and in behalf of said corporation by authority of this governing body.

Corporate
Seal

Title: _____

* Power-of-attorney for person signing for surety company must be attached to bond.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor or Company)

(Address)

a _____, hereinafter called Principal,
(Corporation / Partnership)

and _____
(Name of Surety Company)

(Address)

hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

(Recipient's Address)

hereinafter called OWNER, in the penal sum of \$ _____

Dollars, \$ _____ in lawful money of the United States, for this payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONFIDENTIALITY OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, a copy of which is hereto attached and made a part hereof for the construction of:

(Project Name)

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUB-CONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUB-CONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on

this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ counter-parts, each on of (Number) which shall be deemed an original, this the _____ day of _____.

ATTEST: _____ (Principal)

(Principal Secretary) By _____ (s)

(SEAL)

(Witness as to Principal) (Address)

(Address)

ATTEST: _____ (Surety)

(Witness as to Surety) By _____ (Attorney in Fact)

(Address) (Address)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor or Company)

(Address)

a _____ hereinafter called Principal, and

(Name of Surety Company)

(Address)

hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

(Recipient's Address)

hereinafter called OWNER, in the penal sum of \$ _____ Dollars (\$ ____) in lawful money of the United States, for the payment of which sum well and truly to be made we bind ourselves, successors, and assigns, jointly and severally, firmly in these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER dated the _____ day of _____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW THEREFORE, if the Principal shall well, truly and faithfully perform its duties in all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ day of _____ counterparts, each one of which shall be deemed an original, this the _____ day of _____.

ATTEST: _____
(Principal)

(Principal Secretary) By _____ (s)

(SEAL)

(Witness as to Principal) _____
(Address)

(Address) _____

ATTEST: _____
(Surety)

(Witness as to Surety) By _____
(Attorney in Fact)

(Address) _____
(Address)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

ATTORNEY'S REVIEW CERTIFICATION

I, the undersigned, _____, the duly authorized and acting legal representative of the _____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and am of the opinion that each of the agreements may be duly executed by the proper parties, acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties; and that the agreements shall constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

Attorney's signature: _____ Date: _____

Print Attorney's Name: _____

Disaster Recovery Projects

Attention is called to the fact that not less than, the federally determined prevailing (Davis-Bacon and Related Acts) wage rate, and contained in the contract documents, must be paid on this project. In addition, the successful bidder must ensure that employees and applicants for employment are not discriminated against because of race, color, religion, sex age or national origin.

All contractors/subcontractors that are debarred, suspended or otherwise excluded from or ineligible for participation on federal assistance programs may not undertake any activity in part or in full under this project.

Funding for this project is covered under Section 3 of the Housing and Urban Development Act of 1968. All eligible bidders must comply with Section 3 requirements in regards to meeting or exceeding the required objectives for both hiring and subcontracting. In accordance with these objectives, contractors are required to direct their newly created employment and/or subcontracting opportunities to Section 3 Residents and Business Concerns.



Texas General Land Office
 Community Development Block Grant (CDBG)
 Disaster Recovery Program

SECTION 3
RESIDENT EMPLOYMENT OPPORTUNITY DATA
ELIGIBILITY FOR PREFERENCE

Economic Opportunities for Low and Very Low-Income Persons

Grantee/Subrecipient:	Contract Number:	Date:
<input type="text"/>	<input type="text"/>	<input type="text"/>

ELIGIBILITY FOR PREFERENCE

A Section 3 Resident seeking the preference in training and employment provided by this part shall certify, or submit evidence to the Subrecipient, Grantee, Contractor or Subcontractor, if requested, that the person is a Section 3 Resident, as defined in Section CFR 135.5. (An example of evidence of eligibility for the preference is evidence of receipt of public assistance, or evidence of participation in a public assistance program.)

Section 3 Resident Certification
for Worker Seeking Preference in Training
and Employment

RESIDENT COMPLETES THIS SECTION:

I, _____, am a legal resident of the _____

_____ and meet the income eligibility guidelines for a low- or very-low-income person as published on HUD'S income limits www.huduser.org/portal/datasets/il.html and documented on the reverse side of this form.

My permanent address is: _____

I have attached the following documentation as evidence of my status:

- | | |
|---|---|
| <input type="checkbox"/> Copy of Lease | <input type="checkbox"/> Copy of receipt of public assistance |
| <input type="checkbox"/> Copy of Evidence of participation in a public assistance program | <input type="checkbox"/> Other Evidence |

Resident Signature _____

Date _____

Print Name _____

SECTION 3 INCOME LIMITS

All residents of public housing developments of the Housing Authority of _____

Qualify as Section 3 Residents.

Alternatively, individuals residing in the

City of _____

or County of _____

Who meet the income limits set forth below, can also qualify for Section 3 status.

A picture identification card and proof that illustrates applicant is a current resident of the subject area.

HUD updates area median income (AMI) annually and income limits vary by county. To find the latest income limits visit HUD's website: www.huduser.org/portal/datasets/il.html

Eligibility Guideline

Number in Household	Very Low Income (50% AMI)	Low Income (80%)
1 Individual		
2 Individuals		
3 Individuals		
4 Individuals		
5 Individuals		
6 Individuals		
7 Individuals		
8 Individuals		

Signature Field

Date

Print Name



Texas General Land Office
 Community Development Block Grant (CDBG)
 Disaster Recovery Program

CERTIFICATION FOR BUSINESS CONCERNS
Seeking Section 3 Preference in Contracting and
Demonstration of Capability

Economic Opportunities for Low and Very Low-Income Persons

Grantee/Subrecipient:	Contract Number:	Date:
<input type="text"/>	<input type="text"/>	<input type="text"/>

CONTRACTOR INFORMATION

Name of Business

Address of Business

- Type of Business: Corporation Partnership Non-Profit
 Sole Proprietorship Joint Venture Consortium

Attach the following documentation as evidence of Section 3 eligible status:
 (Definition of "Section 3 Business Concern" in 24 CFR 135 describes the three alternative qualifications.)

For Business claiming status as a Section 3 resident-owned enterprise:

- | | |
|---|---|
| <input type="checkbox"/> Copy of resident lease | <input type="checkbox"/> Copy of receipt of public assistance |
| <input type="checkbox"/> Copy of evidence of participation in a public assistance program | <input type="checkbox"/> Other evidence |

For business entity as applicable:

- | | |
|---|---|
| <input type="checkbox"/> Copy of Articles of Incorporation | <input type="checkbox"/> Certificate of Good Standing |
| <input type="checkbox"/> Assumed Business Name Certificate | <input type="checkbox"/> Partnership Agreement |
| <input type="checkbox"/> List of owners/stockholders and % ownership of each appointed officers | <input type="checkbox"/> Corporation Annual Report |
| <input type="checkbox"/> Organization chart with names and titles and brief function statement | <input type="checkbox"/> Latest Board minutes |
| | <input type="checkbox"/> Additional documentation |

For business entity claiming Section 3 status by subcontracting 25 percent of the dollar awarded to qualified Section 3 business(es):

- List of subcontracted Section 3 business(es) and subcontract amount

For business claiming Section 3 status, by claiming at least 30 percent of their workforce are currently Section 3 residents or were Section 3 eligible residents within 3 years of date of first employment with the business:

- | | |
|---|---|
| <input type="checkbox"/> List of all current full-time employees | <input type="checkbox"/> List of employees claiming Section 3 status |
| <input type="checkbox"/> PHA/IHA Residential lease less than 3 years from day of employment | <input type="checkbox"/> Other evidence of Section 3 status less than 3 years from date of employment |

Evidence of ability to perform successfully under the terms and conditions of the proposed contract:

- | | |
|---|--|
| <input type="checkbox"/> Current financial statement | <input type="checkbox"/> Statement of ability to comply with public policy |
| <input type="checkbox"/> List of owned equipment | |
| <input type="checkbox"/> List of all contracts for the past two years | |

Authorized Name and Signature _____

Date _____

(Corporate Seal)

Attested By: _____



Texas General Land Office
 Community Development Block Grant (CDBG)
 Disaster Recovery Program

**Contractor Certification of Efforts to Fully Comply
 with Employment and Training Provisions of Section 3**

Economic Opportunities for Low and Very Low-Income Persons

THE BIDDER REPRESENTS AND CERTIFIES AS PART OF ITS BID/OFFER THAT IT:

- Is a Section 3 Business Concern. A Section 3 Business Concern means a business concern:
 1. That is 51% or more owned by Section 3 Resident(s); or
 2. Whose permanent, full-time employees include persons, at least 30% of whom are currently Section 3 Residents, or
 3. That provides evidence of a commitment to subcontract in excess of 25% of the dollar value of all subcontracts to be awarded to Section 3 Business Concerns, that meet the qualifications set forth in paragraphs 1 or 2 herein.
- Is **NOT** a Section 3 Business Concern, but who has and will continue to seek compliance with Section 3 by certifying the following efforts to be undertaken.

EFFORTS TO AWARD SUBCONTRACTOR TO SECTION 3 CONCERNS
 (Check ALL that apply)

- By contacting business assistance agencies, minority contractors associations and community organizations to inform them of the contracting opportunities and requesting their assistance in identifying Section 3 businesses which may solicit bids for a portion of the work.
- By advertising contracting opportunities by posting notices, which provide general information about the work to be contracted and where to obtain additional information, in the common areas of the applicable development(s) owned and managed by the Housing Authority.
- By providing written notice to all known Section 3 Business Concerns of contracting opportunities. This notice should be in sufficient time to allow the Section 3 Business Concerns to respond to bid invitations
- By following up with Section 3 Business Concerns that have expressed interest in the contracting opportunities.
- By coordinating meetings at which Section 3 Business Concerns could be informed of specific elements of the work for which subcontract bids are being sought.
- By conducting workshops on contracting procedures and specific contracting opportunities in a timely manner so that Section 3 Business Concerns can take advantage of contracting opportunities.
- By advising Section 3 Business Concerns as to where to seek assistance to overcome barriers such as inability to obtain bonding, lines of credit, financing, or insurance and aiding Section 3 Businesses in qualifying for such bonding, financing, insurance, etc....
- Where appropriate, by breaking out contract work into economically feasible units to facilitate participation by Section 3 businesses.
- By developing and using a list of eligible Section 3 Business Concerns.
- By actively supporting and undertaking joint ventures with Section 3 Businesses.

EFFORTS TO PROVIDE TRAINING AND EMPLOYMENT TO SECTION 3 RESIDENTS

- By entering into a "first source" hiring agreements with organizations representing Section 3 Residents.
- By establishing training programs, which are consistent with the requirements of the Department of Labor, specifically for Section 3 Residents in the building trades.
- By advertising employment and training positions to dwelling units occupied by Category 1 and 2 residents.
- By contacting resident councils and other resident organizations in the affected housing development to request assistance in notifying residents of the training and employment positions to be filled.
- By arranging interviews and conducting interviews on the job site.
- By undertaking such continued job-training efforts as may be necessary to ensure the continued employment of Section 3 Residents previously hired for employment opportunities.
- By posting job vacancies in Work-In-Texas or with my local Workforce Solutions Center.

Contractor Name/Business Name:

Date:

Authorized Representative Name:

Signature:



Texas General Land Office
Community Development Block Grant (CDBG)
Disaster Recovery Program

Code of Federal Regulations
Title 24- Housing and Urban Development

Volume: 1

Date: 2003-04-01

Original Date: 2003-04-01

Title: Section 135.38- Section 3 Clause

Context: Title 24- Housing and Urban Development. Subtitle B- Relating to Housing and Urban Development . Chapter 1- Office of Assistant Secretary for Equal Opportunity, Department. Part 135 Economic Opportunities for Low-and Very Low-Income Persons. Subpart B- Economic Opportunities for Section 3 Residents and Section 3 Business Concerns.

§ 135.38 Section 3 clause.

All section 3 covered contracts shall include the following clause (referred to as the section 3 clause):

- A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.
- B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.
- C. The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.
- D. The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

- E. The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.
- F. Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.
- G. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

TECHNICAL SPECIFICATIONS

FOR

GALVESTON COUNTY GLO SAN LEON MUD MOTOR CONTROL CENTER

Prepared for:

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Houston, Texas 77098

Prepared By:

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TBPE No. F-314



Hatch Project No. H-004596

May 9, 2018
Hatch Associates Consultants, Inc.
TBPE No. F-314

May 2018

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SECTION 01310
CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.0 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this section.

1.01 SUMMARY

A. General:

- 1. This Section specifies administrative and procedural requirements for preparation and report of Contractor's preferred sequence of construction of the Work and other possible sequences of construction of the Work, for monitoring and reporting of actual performance of the Work, for incorporation of changes and unexpected events for determination of possible impacts to the timely completion of the Work and determination of means and methods necessary for timely completion of the Work.

1.02 PROJECT SCHEDULE

A. Detailed Construction Schedule

- 1. The Contractor shall develop and maintain the overall Detailed Construction Schedule (referred to hereafter as Schedule or Construction Schedule). The Schedule shall be developed in the precedence format using Critical Path Method (CPM). The Contractor shall perform its obligations generally in accordance with the sequence and time frame indicated in the Schedule. The Contractor shall update the Schedule as may be required by this Section or as requested by the Owner's representative.

B. Purpose of the Schedule

- 1. Provide additional assurance by the Contractor of its adequate planning, scheduling, and reporting during the execution of the construction and related activities so they may be prosecuted in an orderly and expeditious manner, within the Contract Time and the milestones stipulated herein.

2. Provide additional assurance by the Contractor of the coordination of the work of the Contractor and the various Subcontractors and suppliers at all tiers.
3. Assist the Owner's Representative in monitoring the progress of the work.
4. Assist the Owner's Representative in evaluation of the Contractor's monthly progress payment request.
5. Assist the Owner's Representative in evaluating the potential impact of proposed changes to the Contract.
6. Assist and be utilized by the Contractor in the coordination of its forces, subcontractors, and vendors.
7. Assist in detecting problems for the purpose of taking timely corrective action and to provide a mechanism or tool for determining and monitoring such corrective actions.

C. General Requirements of Submitted Schedules

1. The Work shall proceed at a rate that will meet the specified Milestone Dates, Substantial Completion, and Final Completion dates (if applicable) within the Contract Time. By execution of the Contract, the Contractor represents that he has analyzed the Work, the materials, and methods required, the availability of resources, restrictions of the site, constraints imposed, the availability of the Contractor's own forces, and agrees the specified times are reasonable considering the existing conditions prevailing in the locality of the Work, including weather conditions, and other factors, with reasonable allowances for variations from average or ideal conditions.
2. The Schedule shall clearly identify the activities illustrating accomplishment of the time(s) for completion of the Project set forth in the Contract. If the Schedule indicates earlier completion time(s) than set forth in the Contract, the float between the Schedule and the Contract dates shall be considered part of the total float available.
3. In developing the Schedule, the Contractor shall be responsible for assuring that Subcontract work at all tiers, as well as Contractor's own work, is included in the Schedule.

4. The Schedule as developed shall show the sequence and interdependence of activities required for complete performance of the Work. The Contractor shall be responsible for assuring all work sequences are logical and the Schedule shows a coordinated plan for the Work.
 5. Failure by the Contractor to include any element of work required for performance of the Contract or failure to properly sequence the work shall not excuse the Contractor from completing all work within the Contract Time.
- D. Use of Float and Reasonable Limitations Upon Resources
1. Float time is not for the exclusive use or benefit of either the Contractor or the Owner. The Contractor shall limit its use of logic restraints for resources to equally reserves float for the use of the Owner and the Contractor to be used for future unexpected events.
 2. The Contractor acknowledges and agrees that actual delays to specific activities that do not exceed the total float available to that activity will not have any effect upon the Contract completion time and Contractor will take all available actions necessary to maintain the overall schedule.
- E. Requirements for Additional Resources
1. The Contractor shall provide adequate resources, including but not limited to manpower and equipment, to perform its obligations in a timely manner. The Contractor shall be required to provide additional resources as necessary or required to maintain a rate of progress sufficient to remain on schedule at all times.
 2. If the Contractor and the Owner's Representative agree to a Change Order, such agreement shall be incorporated into the Schedule without affecting the Schedule or other activities, completion date, resources, etc. other than as may be included in the agreed Change Order.
- F. Entitlement to Extension of Time and Acceleration
1. Entitlement to extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustments for the activities affected by any condition or event which entitles the Contractor to a time extension exceed the total float along the current critical path of activities affected.

2. If the Owner's Representative does not provide a time extension at the request of the Contractor, the Contractor shall in a timely manner (10 calendar days) provide a Recovery Schedule and itemized estimate of cost to accelerate work to maintain the schedule or shall be deemed to waive its claim for additional compensation therefore.

PART 2 PRODUCTS

2.0 TECHNICAL REQUIREMENTS OF SUBMITTED SCHEDULES

- A. Contractor shall plan, schedule, execute, and report on the Work using the Critical Path Method (CPM). The principle used herein shall be set forth in the text *CPM in Construction Management*, 7th edition, McGraw hill, except that in case of conflicts, the provisions of the Contract Documents shall govern.
- B. The Contractor shall employ the services of at least one fully qualified scheduler for the duration of the Contract. The scheduler shall have a minimum of 3 years of experience in CPM scheduling on projects of similar size, scope, and complexity. The scheduler shall cooperate with the Owner's Representative and shall be available for continuously monitoring, updating, and reporting on the Contractor's detailed construction schedule.
- C. The Schedule shall be developed utilizing the Precedence Diagramming Method (PDM). Contractor shall use PHOENIX PROJECT MANAGER (www.PhoenixCPM.com) scheduling software version 4 or higher. Other software may be used with prior approval of the Owner's Representative. Microsoft Project will not be allowed. Contractor shall use the software set to the following schedule options: Status on Current; Progress Override; Durations Contiguous; Path Float (Longest Path).

2.01 RESTRICTIONS SUBJECT TO DISCRETION OF OWNER'S REPRESENTATIVE

- A. Milestone Dates, including Notice To Proceed, Substantial Completion, and Final Completion (if applicable) must be adhered to and shall be clearly identified on the Schedule. Milestone Dates may not be changed without prior written consent by the Owner's Representative.
- B. The Schedule shall be developed utilizing activities with durations between 1 and 20 working days. Activities requiring durations longer than 20 working days, such as fabrication and delivery of long lead items, will be allowed only with the approval of the Owner's Representative. Working days are defined as a 5 day work week, less recognized holidays allowed by the Contract. Activities with zero duration such as milestones may be used with the approval of the Owner's Representative.

- C. Logic relationships between activities shall be limited to: finish-start and start-start. Finish-finish relationships shall not be used.
- D. Lags between activities shall not be permitted.
- E. Exceptions to any of the duration or relationship requirements may be allowed at the sole discretion of the Owner's Representative if in his opinion such exceptions would enhance the use of the Schedule.

2.02 REQUIRED LEVEL OF DETAIL AND DURATIONS

- A. The level of detail of the Schedule shall be a function of the complexity of the project. The level of detail and total number of activities shall be subject to the approval of the Owner's Representative. No construction activity shall have a duration longer than twenty (20) working days. Non-construction activities such as procurement and fabrication may have durations greater than twenty (20) work days with approval of the Owner's Representative.
- B. Normal weather conditions shall be considered and included in the planning and scheduling of all work influenced by weather (rain, temperature, snow, etc.). By submitting the Schedule, the Contractor acknowledges that he has reviewed NOAA's records published for last ten (10) years and incorporated the average historic climatic conditions in the Schedule.
- C. All activity descriptions shall be clear and concise and form a complete sentence; (acceptable example: "Form and pour foundation for Building A." Unacceptable example: "Foundation Building A"). The beginning and ending date of each activity shall be readily verifiable. All activity starts and finishes, with the exception of Milestones, must be tied into the schedule by logical restraints.
- D. Proposed duration assigned to each activity shall be the Contractor's best estimate of the time required to complete the activity considering the scope and resources planned for the activity.
- E. Responsibility for each activity shall be identified with a single organization or individual.
- F. For all major equipment, or fabricated materials supplied for this project, the Schedule shall show a sequence of activities including:
 - 1. Preparation of Shop Drawings and sample submissions.

2. Review of Shop Drawings and samples.
3. Shop Fabrication and delivery.
4. Erection and / or installation of the materials or equipment.
5. Start-up, testing, and / or commissioning of the equipment / materials.

2.03 REQUIRED MINIMUM CODING OF ACTIVITIES, RESOURCES, AND COSTS

A. Each activity shall be identified with codes including as a minimum:

1. The party responsible for the performance of the Work.
2. The specification section or Division for the Work.
3. The total man-hours estimated to perform the Work.
4. The value, in dollars, for the Work

B. Contractor

1. Manpower
2. The cumulative assigned labor man-hours for each activity must equal the total man-hours assigned in the activity code tabulation.

C. Each activity shall be cost-loaded and the assigned dollar value (cost-loading) of each activity shall cumulatively equal the Total Contract Amount. Separate activities shall be included and cost loaded for costs associated with mobilization, demobilization, bond, and insurance. The cost for demobilization shall be at least 75% of the that for mobilization. Cost for General Conditions, overhead, and profit, shall be prorated throughout all activities other than those for mobilization, demobilization, bond, and insurance.

1. The assigned dollar value (cost-loading) of each activity shall be coded against one or more cost category and cost account number. Cost accounts numbers shall be the same as line items in the Schedule of Values. The assigned dollar value (cost-loading) for each cost account shall cumulatively equal the Total Contract Amount assigned for each respective line in the Schedule of Values.

2.04 REQUIRED NARRATIVE

- A. Contractor shall prepare and provide a written narrative to further explain the plan as set forth in its CPM logic network and schedule. The narrative shall include a general summary of the Contractor's proposed plan to execute the remaining work on the project. The narrative shall include an explanation of the Contractor's plan to provide adequate manpower, equipment, and subcontractors to prosecute the Work and remain on schedule.
- B. The Contractor's narrative shall include a section describing all of the activities that have been updated, any changes to logic, all activities behind schedule, the critical path from this data date to Substantial Completion, and a general review of the progress to date relative to the original plan.

PART 3 EXECUTION

3.0 TECHNICAL REQUIREMENTS OF SUBMITTED SCHEDULES

- A. Within three (3) working days after date of Notice-To-Proceed, Contractor shall designate its authorized project scheduler (Scheduler).
- B. Contractor's scheduler shall have complete authority to act on behalf of the Contractor in fulfilling the Construction Schedule requirements of the Contract and such authority shall not be interrupted throughout the duration of the Contract without approval of Owner's Representative.

3.01 INITIAL SCHEDULE CONFERENCE

- A. The Owner's Representative will schedule an initial schedule conference within ten (10) working days of Notice to Proceed to review the schedule requirements, sequence of work, manpower requirements, cost loading, and the use of the schedule throughout the project.
- B. The conference will be attended by: the Contractor's Project Manager, Superintendent; Scheduler.
- C. The Owner's Representative will review the following; development of the Preliminary Schedule, procedures for updating and revisions, cost loading, man-hour loading, cost accounts, method for exchanging data and delivery of reports, procedures for assessing impacts and evaluation of time extensions.

3.02 PRELIMINARY SCHEDULE

- A. Within ten (10) days after Notice to Proceed, the Contractor shall submit for the Owner's Representative's review and acceptance a Preliminary Schedule.
- B. The Preliminary Schedule shall cover the following project phases and activities:
 - 1. Proposed procurement activities to be accomplished in the first 90 days of the Contract. Procurement activities shall include mobilization, key shop drawing and sample submittals, reviews, and the fabrication and delivery of key and long-lead procurement elements. Indicated planned submittal dates and delivery dates for fabrication and delivery activities.
 - 2. Proposed construction activities to be accomplished the first ninety (90) days of the Contract.
 - 3. Summary activities not included above which are necessary to properly indicate the approach to scheduling the remaining phases of the project.
 - 4. The Preliminary Schedule shall otherwise conform to the requirements outlined in the "Technical Requirements for Contractor-submitted Schedules" in this specification section.
- C. Within seven (7) working days after receipt by the Owner's Representative of the Preliminary Schedule, the Owner's Representative will notify the Contractor of any concerns with regard to the Preliminary Schedule.
 - 1. The Contractor shall provide a response to the Owner's Representatives' concerns with five (5) working days, and within three (3) working days for subsequent responses.
 - 2. The Preliminary Schedule shall be updated on a monthly basis while the Baseline Schedule is being developed.

3.03 BASELINE SCHEDULE

- A. Within thirty (30) days of Notice to Proceed, Contractor shall submit to Owner's Representative a detailed Baseline Schedule in precedence format for the Contractor's scope of work.
- B. The Baseline Schedule shall conform with the requirements outlined in the "Technical Requirements for Contractor-submitted Schedules" in the specification section.

- C. The Baseline Schedule shall be prepared in accordance with the comments and concerns raised by the Owner's Representative relating to the Preliminary Schedule. If such concerns have not been fully addressed for the Preliminary Schedule prior to the deadline in Section 3.4.1 above, the Contractor shall nevertheless submit its work in progress as of that date.
- D. The submission shall consist of: an electronic backup file (.ppx) of the Schedule; a classic schedule report; a cost account report; a critical path report / chart.
- E. The Owner's Representative shall review the schedule and provide the Contractor of any concerns within fifteen (15) working days, seven (7) working days for any subsequent changes. The Contractor shall provide a written response to the concerns of the Owner's Representative within five (5) working days for the first response and three (3) working days for subsequent responses as required.
 - 1. If requested by the Owner's Representative after receipt of the Contractor's responses, the Contractor shall meet and conduct a joint review of the schedule, make corrections, or adjustments. The Contractor will make any necessary changes agreed to in the joint meeting to the satisfaction of the Owner's Representative within three (3) working days.
 - 2. If the Baseline Schedule is not approved within sixty (60) days of the Notice to Proceed, the Owner's Representative may assess the Contractor liquidated damages in the amount of \$1,000 per day for each and every day until the Baseline Schedule is approved to reimburse the Owner for the additional risk of late completion, and the increased monitoring and administration associated with attempts to control and mitigate such risk.
- F. Acceptance of Contractor's Baseline Schedule:
 - 1. Acceptance by the Owner's Representative of the Contractor's Baseline Schedule shall be a condition precedent to making any progress payments under the Contract after the first seventy-five (75) working days of the Contract at the discretion of the Owner's Representative. At the Owner's Representative's sole discretion, he may choose to deny any progress payment, make partial payments, require additional retainage, or make partial payments solely upon certified payrolls and vendor invoices.

3.04 USE OF SCHEDULE FOR PROJECT COORDINATION

A. Weekly Progress Meetings

1. Once each week at the progress meeting, the progress achieved by the Contractor during the previous work week will be assessed. The Contractor shall update the most recent Schedule with the Actual Start date of activities started in the past week, the Remaining Duration of those activities in progress, and the Actual Finish date of activities completed during the past week. The Contractor shall submit a progress schedule in electronic format (.ppx) so the Owner's Representative can review the progress and the work planned for the next four (4) week period.
2. During the progress meeting, the Contractor shall indicate which activities during the next four (4) week period he will actually be performing.

B. Minor Revisions to the Schedule for Unanticipated Events

1. If the Contractor and Program Manager agree to a Change Order, such agreement shall include an Impact Analysis and agreement on the acceptance for such impact (in part or whole by each party) and costs for mitigation thereof. In the event that such agreement is not part of the agreement for the price of the Change Order, the Contractor shall treat such Change Order as a directive for purposes of the schedule.
2. If the Contractor believes that a submitted Request for Information (RFI), claimed Change in Condition, request to delay or defer work pending a Proposed Change Order (PCO), directive to perform a Change Order (CO) or claimed Constructive Change Order (CCO) may impact its work, the Contractor shall perform an Impact Analysis upon a copy of the most recent "UPDATE" file and submit such to the Program Manager as soon as practicable after determination of such belief. The failure to so promptly notify the Program Manager shall be deemed a waiver of any compensation or extension of time due to such cause. Where the parties are in disagreement over the responsibility of the delaying event, the Contractor shall use a description for such which is responsibility neutral.
3. As part of its Impact Analysis, the Contractor shall suggest means of mitigation including but not limited to use of greater resources, modification or deletion from the logic network of selected restraints and selective overtime.

If the Contractor believes that its efforts to mitigate such impact will entitle it to additional compensation, the Contractor shall submit an estimate of the unmitigated and mitigated impact and cost consequences of each. The failure to provide such a submittal in a timely manner shall be deemed a waiver of any additional compensation.

C. Monthly Schedule Update Meetings

1. On a monthly basis, the Contractor shall meet with the Owner's Representative for the purpose of updating the Schedule. The Contractor shall submit its assessment of the Actual Start date of activities started since the last update, Remaining Duration of those activities in progress, Actual Finish date of activities completed, and Cost Percent Complete of activities in progress or complete. The Owner's Representative will either assent to the Contractor's assessment or direct the Contractor to use other dates or Percent Complete. The Owner's Representative may request the Contractor to provide additional assurance of a Remaining Duration of work in progress.
2. The information shall be entered to a copy of the most recent "UPDATE" file which will be saved and not further modified.
3. Monthly Update Reports submission shall consist of: an electronic backup copy of the schedule (.ppx), a Classic Schedule Report, a Cost Account Report, and a Longest Path Report.

3.05 MAJOR REVISIONS TO THE SCHEDULE

- A. In the event that, pursuant to a Change Order, a Revised Baseline Schedule is adopted for the work remaining on the project, such a revised baseline Schedule shall be used as the target update to the project.

3.06 USE OF SCHEDULE TO SUPPORT PAY APPLICATION

- A. The Schedule will be used to support the Contractor's monthly pay applications. No pay application shall be submitted that exceeds the cumulative value of the cost-loaded activities.
- B. The sum of the value of the cost-loaded activities shall equal the Contract value plus any changes.
- C. Activities shall only have three (3) possible states of completion: Not yet started = 0% complete; Started = 50% complete; Finished = 100% complete.

- D. The cumulative valued of the progressed cost-loaded activities shall equal the earned value to date.
- E. The cumulative sum of the activities assigned to each cost account shall be the earned value to date for each of the cost accounts in the Schedule of Values.
- F. The Contractor and Owner's Representative will meet to review the Contractor's earned value prior to the preparation of the monthly pay application. In case of any disagreement concerning the status of an activity the Owner's Representative's decision will be final.

3.07 Recovery Schedule

- A. In the event that the Contractor or the Owner's Representative determines the Contractor can no longer perform according to the schedule, the Contractor shall prepare and submit a Recovery Schedule.
- B. In the event the Most Recent Update indicates the project is more than twenty (20) days behind schedule, or the Contractor becomes aware of an anticipated delay that will likely cause the project to be delayed by more than twenty (20) days, and upon notice of such and subsequent request from the Owner's Representative, the Contractor shall prepare and submit a Recovery Schedule.
- C. The Recovery Schedule shall include without limitation:
 - 1. Revision to the Original Durations of Activities not yet started, which are individually supported with a narrative of the actual productivity to date or increased resources or hours per day to increase productivity to accelerate completion.
 - 2. Revisions to the number of work days per week, including work on Saturdays, Sundays, and / or holidays, or working additional shifts.
 - 3. Splitting activities to all more precise coordination between crews or subcontractors.
 - 4. Revisions to Logical Relationships along with a narrative indicating the ability and willingness to engage additional resources.
- D. The Recovery Schedule shall be prepared to indicate, where practicable, recovery within one month or within ten percent (10%) of the remaining project duration until the mandated deadline is threatened.

- E. Recovery Schedule Reports submission shall consist of:
 - 1. All reports required for an Update
 - 2. The timescaled logic diagram highlighted to indicated how the Recovery Schedule differs from the Baseline Schedule.
- F. Where the Recovery Schedule has been ordered by the Owner's Representative, it shall be submitted with five (5) working days. The Contractor and all parties required at the Initial Schedule Conference shall be prepared to attend the Schedule Recover Meeting.
- G. Once approved by the Owner's Representative, the Recovery Schedule shall be treated as a Minor Revision to the Schedule or a Major Revision to the Schedule as directed by the Owner's Representative.
- H. Once approved by the Owner's Representative, failure by the Contractor to strictly follow the Recovery Schedule until back on schedule shall be deemed a Material Breach of the Contract.

END OF SECTION

SECTION 01321
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Photographic requirements for construction photographs and submittals.

1.02 DEFINITIONS

- A. Pre-construction Photographs: Photographs taken, in sufficient numbers and detail, prior to Date of Commencement of the Work, to show original construction site conditions.
- B. Progress Photographs: Photographs, taken throughout the duration of construction at regular intervals and from fixed vantage points, pre-approved by the Engineer, that document progress of the Work.
- C. Finished Photographs: Photographs, taken by a professional photographer near Date of Substantial Completion and before Owner acceptance of the Work, that are suitable for framing and for use in brochures or on the Internet.

1.03 SUBMITTALS

- A. Refer to Section 01300, Submittal Procedures, for submittal requirements.
- B. Format and Media. Film or digital photography may be used. Submit color photographs, unless otherwise specified.
 - 1. Prints. Submit each Progress or Pre-construction Photograph print in a three-hole plastic pocket or sleeve, bound in a three-ring notebook. Produce prints on photographic-quality paper approved by Project Manager. Minimum size for Pre-construction Photograph prints shall be 3-inches by 5-inches. Progress Photographs prints shall be 8-inches by 10-inches. Upon request by the Contractor and prior approval by the Owner, digital photographs may be printed two to a page.
 - 2. Film. Use 35mm or larger color film. Submit negatives used to make submitted photographs, in 3-hole 8 ½ inch by 11-inch plastic sheets with sleeves for negatives.

3. Digital Photography. Use 7 megapixel density or greater for photographs. Scanned photographs must equal or exceed 400 dots per inch when scanned from 8-inch by 10-inch prints. Submit digital photographic files on computer disks. Format disks for MS-DOS filing system and in JPEG format.
- C. Submittal Quantities and Frequencies.
1. Pre-construction Photographs:
 - a. For Stipulated Price Contracts, submit two sets of Pre-construction photographs, if required, prior to first Application for Payment.
 - b. For Unit Price Contracts, submit two sets of Pre-construction Photographs prior to start of construction operations.
 2. Progress Photographs:
 - a. For Stipulated Price Contracts, submit three sets of Progress
 - b. Photographs with each Application for Payment at the times established for submittal of Applications for Payment. Monthly Applications for Payment shall be deemed incomplete if not accompanied by the required Progress Photographs. Contractor's failure or election to not submit a monthly Application for Payment shall not affect the requirement for monthly Progress Photographs.
 - c. Progress Photographs are not required for Unit Price Contracts unless otherwise specified.
 3. Finished Photographs: For Stipulated Price Contracts submit two sets of Finished Photographs, if required, after Date of Substantial Completion and prior to final payment. Each set shall contain one 11-inch by 14-inch matte finish color photographic print from each of the two vantage points pre-approved by the Engineer. Vantage points for Finished Photographs will be approved separately from vantage points approved for Progress Photographs. Finished Photographs are not required for Unit Price Contracts unless otherwise specified.

- D. Labeling:
1. Film & Prints (traditional photography) – Place a label on the back of each photographic print, applied so as to not show through on the front. Labels shall contain the following information:
 - a. Name of Project, address of Project.
 - b. Name and address of Contractor.
 - c. Date photograph was taken.
 - d. Location photo was taken from and short description of photo subject.
 - e. Name and address of professional photographer who took the photograph, if applicable.
 2. Digital Photography – Annotate the prints by adding labels / captions so as to not obscure the subject of the photo which include the following information:
 - a. Name of Project, address of Project.
 - b. Name and address of Contractor.
 - c. Date photograph was taken.
 - d. Location photo was taken from and short description of photo subject.
 - e. Name and address of professional photographer who took the photograph, if applicable
 - f. Filename of the photograph
- E. Hand-deliver or transmit prints in standard photographic mailers marked “Photographs-Do Not Bend”.
- F. Photographic prints, negatives, photographic files and disks become the property of the Owner. Do not publish photographs without written consent by the Owner.

1.04 QUALITY ASSURANCE

- A. Contractor shall be responsible for the quality of and timely execution and submittal of photographs.
- B. For Finished Photographs, Contractor shall use a professional photographer, with five years minimum professional experience in the Houston area. Contractor shall submit name, address and credentials of professional photographer for Project Manager's review and approval.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION PHOTOGRAPHS

- A. Prior to commencement of construction operations, photograph the site to include initial construction corridor, detour routes, and staging or storage areas.
 - 1. For Stipulated Price Contracts, unless specified as a requirement in other Sections, these photographs are optional for Contractor, but are highly recommended for areas bounded by other property owners.
 - 2. Pre-construction photographs are required for Unit price Contracts. For line projects with scheduled construction segments, take Pre-construction Photographs prior to commencement of work on each segment.
- B. Prepare Pre-construction Photographs as follows:
 - 1. Show the following information on a non-reflective chalkboard (or digitally annotated) placed within the picture frame:
 - a. Job number
 - b. Project number
 - c. Date and time photographs were taken (Automatic date/time in negative is acceptable).
 - d. Baseline station, direction of view (i.e. N, S, NW, etc.) and house number or street address and street name.

2. Pre-construction Photographs shall indicate condition of the following:
 - a. Esplanades and boulevards
 - b. Yards (near side and far side of street).
 - c. House walks and sidewalks.
 - d. Curbs.
 - e. Areas between walks and curbs.
 - f. Particular features (e.g. yard lights, shrubs, fences trees).
3. Show date photographs were taken on negatives.
- C. Show the location of vantage points and direction of shots on a key plan of the site.

3.02 PROGRESS PHOTOGRAPHS

- A. Progress Photographs document monthly advancement of Work. Select vantage points for each shot so as to best show status of construction and progress since last photograph submittal. Select camera stations that will require little or no movement or adjustment over the duration of construction.
- B. Take monthly Progress Photographs at regular intervals to coincide with cutoff dates associated with each Application for Payment.

3.03 FINISHED PHOTOGRAPHS

- A. Finished Photographs shall be “staged” and taken by a professional photographer to depict the most flattering images of a finished facility. Two vantage points, from which Finished Photographs will be taken, shall be agreed to in advance by the Engineer. Photographer shall consider lighting, time of day, height of eye, landscaping and placement of vehicles, people and other props in each picture. Filters and post-photography processing may be utilized to achieve a finished product acceptable to the Owner.

3.04 LOCATION

- A. Vantage points, times and conditions for camera stations and photography for progress and Finished Photographs shall be mutually agreed upon by the Engineer, Contractor and Photographer. Progress Photograph vantage points may be changed by mutual agreement as the Work progresses, at no additional cost to the Owner.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 – GENERAL

1.01 SCOPE

- A. This section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:
1. Contractor's Construction Schedule
 2. Submittal Schedule
 3. Weekly Construction Reports
 4. Shop Drawings
 5. Product Data
 6. Samples
 7. Quality Assurance Submittals
 8. Permits
 9. Applications for Payment
 10. Bonds
 11. Insurance Certificates
 12. List of Subcontractors

1.02 DEFINITIONS

- A. Coordination Drawings: Show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
- B. Field Samples: Are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- C. Mockups: Are full-size assemblies for review of construction, coordination, testing, or operation; they are not samples.

1.03 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
- B. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 1. Allow 2 weeks for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
 2. If an intermediate submittal is necessary, process the same as the initial submittal.
 3. Allow 2 weeks for reprocessing each submittal.
 4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 1. Provide a space approximately 4 by 5 inches on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken:
 - a. Project name;
 - b. Date;
 - c. Name and address of the Engineer;
 - d. Name and address of the Contractor;
 - e. Name and address of the subcontractors;
 - f. Name and address of the supplier;
 - g. Name of the manufacturer;
 - h. Number and title of the appropriate specification section; and
 - i. Drawing number and detail references, as appropriate.
- D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. The Engineer will not accept submittals received from sources other than the Contractor.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 14 days after the date established for commencement of the Work.
1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
 2. Within each time bar, indicate estimated completion percentage in 20-percent increments. As Work progresses, place a contrasting mark in each bar to indicate actual completion.
 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence; indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit work by separate contractors and partial occupancy by the Owner affect the sequence of the Work.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.
- D. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.
- E. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer (the Engineer shall be provided with 2 copies), subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

- F. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.05 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days after the preconstruction conference.
 - 1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
 - 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Scheduled date of submittal;
 - b. Related section number;
 - c. Submittal category (Shop Drawing, Product Data, or Sample);
 - d. Name of the subcontractors;
 - e. Description of the part of the work covered;
 - f. Scheduled date of resubmittal (if required); and
 - g. Scheduled date for the Engineer's final release or approval.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.06 WEEKLY CONSTRUCTION REPORTS

- A. Prepare a weekly construction report recording the following information concerning events at the site, and submit duplicate copies to the Engineer at weekly intervals:
 - 1. List of subcontractors at the site;
 - 2. High and low temperatures/general weather conditions;
 - 3. Accidents and unusual events;
 - 4. Meetings and significant decisions;
 - 5. Stoppages, delays, shortages, and losses;
 - 6. Orders and requests of governing authorities;

7. Change orders received/implemented;
8. Services connected/disconnected;
9. Equipment or system tests and startups;
10. Partial completions/occupancies;
11. Substantial completions authorized;
12. Submittals submitted to the Engineer; and
13. Submittals approved or rejected by the Engineer.

1.07 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. **DO NOT** reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates, and similar Drawings. Include the following information:
 1. Field and erection dimensions clearly identified as such;
 2. Arrangement and section views;
 3. Relation to adjacent materials or structures, including complete information for making connections between work under this Contract and work under other contracts;
 4. Assembly drawings of equipment components and accessories showing their respective positions and relationships to the complete equipment package;
 5. Identification of products and materials included by sheet and detail number;
 6. Compliance with specified standards;
 7. Notation of coordination requirements;
 8. Notation of dimensions established by field measurement; and
 9. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8½ by 11 inches but no larger than 24 by 36 inches.
- C. Submittal: Submit at least 6 copies for the Engineer's review. The Engineer will return 3 copies marked with actions taken and corrections or modifications required.
- D. One of the prints returned shall be marked up and maintained as a "PROJECT RECORD" document.
- E. **DO NOT** use Shop Drawings without an appropriate final stamp indicating action taken.

1.08 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations;
 - b. Compliance with trade association standards;
 - c. Compliance with recognized testing agency standards;
 - d. Application of testing agency labels and seals;
 - e. Notation of dimensions verified by field measurement; and
 - f. Notation of coordination requirements.
 - 2. **DO NOT** submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- B. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
- C. Submittals: Submit 6 copies of each required submittal. The Engineer will retain 3 copies and will return the other marked with action taken and corrections or modifications required.
 - 1. Unless noncompliance with Contract Document provisions is observed the submittal may serve as the final submittal.
- D. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - 1. **DO NOT** proceed with installation until a copy of Product Data is in the Installer's possession.
 - 2. **DO NOT** permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

- A. Submit samples that include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern. Include the following:
 - 1. Specification section number and reference;

2. Sample source;
 3. Product name or name of the manufacturer; and
 4. Availability and delivery time.
- B. Submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
1. Where variation in color, pattern, texture, or other characteristics is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 2. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of use. On transmittal, indicate special requests regarding disposition of Sample submittals.
 3. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

1.10 QUALITY ASSURANCE SUBMITTALS

- A. Submit Quality Control Submittals, including design data, certificates, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the Specifications.
- B. Certifications: Where other sections of the Technical Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in section entitled "TESTING LABORATORY SERVICES."

1.11 ENGINEER'S ACTION

- A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken and return promptly.
1. Compliance with specified characteristics is Contractor's responsibility.
- B. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Engineer marks a submittal “Approved,” the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Final-But-Restricted Release: When the Engineer marks a submittal “Approved as Noted,” the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
3. Returned for Resubmittal: When the Engineer marks a submittal “Revise and Resubmit,” **DO NOT** proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
 - a. **DO NOT** use, or allow others to use, submittals marked “Revise and Resubmit” at the Project Site or elsewhere where Work is in progress.
4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked “Not Approved.”

1.12 UNSOLICITED SUBMITTALS

- A. The Engineer will return unsolicited submittals to the sender without action.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SPECIFICATION -

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 SCOPE

- A. The facilities and controls specified in this section are considered minimum for the project. After obtaining approval, the Contractor may provide additional facilities and controls which he considers necessary for proper execution of the work to meet his responsibilities for protection of persons and property.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for any temporary facilities and controls required under this section. Include the cost of such work as incidental to items listed in the Bid Form.

PART 2 – MATERIALS

2.01 BUILDINGS

- A. Storage
 - 1. Provide water tight storage containers of suitable size with floor above ground level for all materials susceptible to weather damage. Storage of other materials on blocks off the ground is acceptable. Place materials to permit easy access for inspection and identification.
- B. Other Buildings
 - 1. The location or building of structures or other forms of protection will not be permitted without approval.

2.02 PROJECT SIGN

- A. Signs will not be permitted on the project site without approval.

2.03 UTILITIES - TEMPORARY CONNECTIONS

- A. Arrange and secure all temporary connections for water, electricity, gas, and other services needed to do the work. The cost of connection and use is paid for by the Contractor.

2.04 SANITATION

- A. Provide and maintain sanitary conveniences to satisfy requirements of local or state health authorities, ordinances, and laws. Obtain approval for location, secluded from public view.

2.05 ACCESS ROAD AND PARKING

- A. Access and parking at the site is not limited by provisions other than those concerning freedom of access and protection of adjoining property.

PART 3 – EXECUTION

3.01 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS

- A. Remove all temporary buildings, storage containers, sanitary conveniences, and signs before requesting final payment from Owner. Disconnect all temporary utility connections. Clear the area of unnecessary safety items and temporary controls. Remove or restore, as required, all temporary roads and parking areas. Clean up the entire area as specified in the section entitled “CLEANING AND ADJUSTING.”

- END OF SPECIFICATION -

SECTION 01576

WASTE MATERIAL DISPOSAL

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Disposal of waste material and salvageable material.

1.02 SUBMITTALS

- A. Obtain and submit disposal permits for proposed disposal sites if required by local ordinances.
- B. Submit a copy of written permission from property owner, along with description of property prior to disposal of excess material adjacent to the Project. Submit a written and signed release from property owner upon completion of disposal work.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 SALVAGEABLE MATERIAL

- A. Excavated Material
 - 1. When indicated on Construction Plans, load, haul, and deposit excavated material at a location or locations shown on Construction Plans outside the limits of Project.

3.02 EXCESS MATERIAL

- A. Vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage, shall become the property of Contractor and shall be removed from the job site and legally disposed of in a manner not causing damage to the Owner.
- B. Excess soil may be deposited on private property adjacent to the Project when written permission is obtained from property owner. See Paragraph 1.02.B above.
- C. Verify the flood plain status of any proposed disposal site. Do not dispose of excavated materials in an area designated as within the 100-year Flood Hazard Area.

- D. Waste materials shall be removed from the site on a daily basis, such that the site is maintained in a neat and orderly condition.

- END OF SPECIFICATION -

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE

- A. This section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1.02 DEFINITIONS

- A. Definitions in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 2. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 3. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of Work.
 - 4. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.03 SUBMITTALS

- A. Subcontractors and Suppliers
 - 1. Contractor shall furnish a list of proposed subcontractors, suppliers, manufacturers, and installers.
- B. Product Data
 - 1. Shop Drawings: Submit shop and installation drawings for review by the Engineer, as required, per each section of the Technical Specifications.
 - 2. Test Reports: Deliver certified copies, as required per each section of the Technical Specifications, evidencing compliance with all requirements of the Technical Specifications to the Engineer.

3. Submit trade or brand names of manufacturers and complete description of products, as required per each section of the Technical Specifications.
 4. Catalog Data: Submit manufacturer's descriptive literature and/or technical product data for each item, as required per each section of the Technical Specifications.
 5. Warranty: Submit manufacturer's warranty against failure, as required per each section of the Technical Specifications.
- C. Engineer's Action: The Engineer will respond in writing to Contractor within 2 weeks of receipt of the submittals. No response within this period constitutes no objection but does not constitute a waiver of the requirements that must be complied with in the Contract Documents. The Engineer's response will include a list of unacceptable submittals containing a brief explanation of reasons for this action.

1.04 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source. When specified products are available only from sources that do not, or cannot, produce quantity adequate to complete project requirements in a timely manner, consult with the Engineer to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
- B. Compatibility Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. Each Contractor is responsible for providing the products and construction methods that are compatible with products and construction methods of other prime or separate contractors.
 2. If a dispute arises between Contractors over concurrently selectable, but incompatible products, the Engineer will determine which products shall be retained and which are incompatible and must be replaced.
- C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
1. No available domestic product complies with the Contract Documents.
 2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.
- D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer
 - b. Model and serial number
 - c. Capacity
 - d. Speed
 - e. Ratings

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

PART 2 – PRODUCTS

2.01 PRODUCT SELECTION

- A. Provide products that comply with the Contract Documents, that are undamaged, and that, unless otherwise indicated, are new at the time of installation.
- B. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
- C. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract Documents.

- D. Performance Specification Requirements: Where specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
 - 1. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes, and Regulations: Where specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.

PART 3 – EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located, and aligned with other Work.
- B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- END OF SPECIFICATION -

SECTION 01660

CLEANING AND ADJUSTING

PART 1 – GENERAL

1.01 RESPONSIBILITY

A. Cleaning and Adjusting

1. The Contractor is responsible for cleaning and adjusting the work. If the Contractor fails to clean and adjust the work, the Owner may do so and charge the resulting costs to the Contractor.

B. Details

1. Detailed cleaning and adjusting requirements for specific trades or work are specified in the sections pertaining to that trade or work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Fire Protection

1. Store volatile waste in covered metal containers and remove from premises daily.

B. Pollution Control

1. Conduct cleaning and disposal operations in compliance with local ordinances and anti-pollution laws.
 - a. Burying of rubbish and materials on the project site is not permitted.
 - b. Disposal of volatile fluid wastes and other chemical wastes in storm or sanitary sewer systems or into streams or waterways is not permitted.

C. Safety Standards

1. Maintain the project in accordance with insurance and safety standards.

1.03 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for any cleaning and adjusting required under this section. Include the cost of such work as incidental to items listed in the Bid Form.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 DURING CONSTRUCTION

A. General

1. Oversee cleaning to ensure that the premises are maintained free from accumulations of waste material and rubbish. Do not allow waste materials, rubbish, and debris to accumulate and become unsightly or create a hazard. Provide containers and locate on site for collection of waste materials, rubbish, and debris.

B. Collection

1. At reasonable intervals during progress of the work, collect and dispose of waste materials, rubbish, and debris. Handle waste in a controlled manner; do not drop or throw materials from heights.

C. Disposal

1. Remove waste materials, rubbish, and debris from the site and legally dispose at public or private dumping area off the project site.

3.02 FINAL CLEANING AND ADJUSTING

- A. Use experienced personnel for final cleaning. Broom-clean paved surfaces; rake clean other surfaces of grounds. Remove all waste material and rubbish from the project area, as well as all tools, construction equipment, machinery, surplus materials, and temporary facilities. Immediately prior to acceptance or occupancy, verify that exposed interior and exterior surfaces are properly cleaned.

3.03 ADJACENT AREAS

- A. To the Owner's satisfaction, clean or repair adjacent areas affected by the construction. Remove dust and debris in the adjacent area. Repair, patch, and touch-up marred surfaces to match adjacent finishes.

- END OF SPECIFICATION -

SECTION 01710

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 GENERAL

- A. Prepare and maintain record documents for the project to accurately reflect the construction as built. Documents must be submitted at work completion as a condition of final acceptance. Mark all changes with red ink or pencil.

1.02 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintain at the job site, one copy of:
 - 1. the Contract Documents (including Construction Plans and all Technical Specifications, addenda, change orders, etc.),
 - 2. contract modifications, and
 - 3. field test records.
- B. Store record documents in an approved location apart from documents used for construction. Do not use record documents for construction purposes. Provide files and racks for orderly storage. Maintain documents in a clean, dry, legible condition. Make documents available at all times to the Engineer.

1.03 RECORDING

- A. Keep record documents current. Do not permanently conceal any work until required information has been recorded.
- B. Label each document “PROJECT RECORD” in 2-inch high printed letters. Legibly mark contract drawings to record actual construction:
 - 1. Horizontal and vertical location of underground and under-slab utilities and appurtenances referenced to permanent surface improvements.
 - 2. Location of internal utilities and appurtenances referenced to permanent surface improvements.
 - 3. Field changes of dimension and detail.
 - 4. Changes made by change order or field order.
 - 5. Details not on original contract drawings.
- C. Legibly mark specifications and addenda to record:
 - 1. Manufacturer, trade name, catalog number and supplier of each product, and item of equipment actually installed.

2. Changes made by change order or field order.
3. Other matters not originally specified.

1.04 SUBMITTAL

- A. At project completion, deliver record documents to the Engineer. Place all letter-sized material in a three-ring binder, neatly indexed. Bind Construction Plans and Shop Drawings in rolls of convenient size for ease of handling.
- B. Accompany the submittal with a transmittal letter in duplicate, containing:
 1. the date,
 2. the project title and number,
 3. the Contractor's name and address,
 4. title and number of each record document,
 5. a certificate that each document as submitted is complete and accurate, and
 6. the Contractor's signature.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SPECIFICATION -

SECTION 01782

OPERATIONS AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Submittal requirements for equipment and facility operating and maintenance manuals.

1.02 SUBMITTALS

- A. Along with the schedule for other submittals, as required in the section entitled “SUBMITTALS,” submit a list of operation and maintenance manuals and parts manuals to be provided.
- B. Submit documents, bound in 8½-inch by 11-inch text pages, 3-ring/D binders with durable plastic covers.
- C. Prepare binder covers with printed title “OPERATION AND MAINTENANCE INSTRUCTIONS,” title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- E. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties.
- F. Within one month prior to placing the equipment or facility in service, submit 2 copies of operation and maintenance manual and parts manual for *initial* review and comment.
- G. Submit one copy of completed volumes in final form 10 days prior to final inspection. This copy will be returned after final inspection, with Engineer's comments based on final inspection. Revise content of documents as required prior to final submittal.
- H. Revise and resubmit 4 copies of final version within 10 days after receipt of comments associated with final inspection.

1.03 EQUIPMENT OPERATION AND MAINTENANCE DATA

- A. Furnish operation and maintenance manuals for all equipment. Operation and maintenance manual must contain all information required for Owner to operate, maintain, and repair equipment. The manual must be prepared by equipment manufacturer, furnished to the Engineer by Contractor, and, as a minimum, contain the following:
 1. Equipment functions, normal operating characteristics, and limiting conditions.
 2. Assembly, installation, alignment, adjustment, and checking instructions.
 3. Operating instructions for start-up, normal operation, regulation and control, normal shutdown, and emergency shutdown.
 4. Lubrication and detailed maintenance instructions. The maintenance instructions are to include detailed drawings giving the location of each maintainable part and lubrication point and detailed instructions on disassembly and reassembly of the equipment.
 5. Troubleshooting guide.
 6. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.
 7. Outline, cross-section, and assembly drawings; engineering data; wiring diagram.
 8. Test data and performance curves.
- B. Furnish parts manuals for all equipment. The manual must be prepared by equipment manufacturers, furnished to Engineer by Contractor, and, as a minimum, contain the following:
 1. Detailed drawings giving the location of each maintainable part.

2. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

- END OF SPECIFICATION -

SECTION 02130

NONWOVEN GEOTEXTILE FILTER FABRIC SILT FENCE

PART 1 – G E N E R A L

1.01 DESCRIPTION

- A. This specification describes the installation of erosion and sedimentation control nonwoven geotextile filter fabric silt fence utilized during construction and prior to the final development of the site.

1.02 SUBMITTALS

- A. Manufacturer's catalogue sheets and other pertinent information on filter fabrics showing that they meet or exceed requirements of this specification.

PART 2 – P R O D U C T S

2.01 MATERIALS

- A. Nonwoven Geotextile Filter Fabric:
 - 1. Composed of either:
 - a. Polypropylene material
 - b. Polyethylene material
 - c. Ethylene material
 - d. Or polyamide material
 - 2. Grab strength of at least 100 lbs. in any principal direction.
 - 3. Mullen burst strength exceeding 200 psi.
 - 4. Equivalent opening size of between 50 and 140.
 - 5. Water flow rate of 10 gallons per minute per square foot at 50 millimeters constant head as determined by multiplying permittivity (in 1/seconds) as determined by ASTM D-4491 by a conversion factor of 74.

6. Ultraviolet ray inhibitors and stabilizers to provide a maximum of 6 months of expected usable life at a temperature range of 0 degrees F to 120 degrees F.
 7. Ultraviolet radiation stability of 90%.
 8. Fabric reinforced with support netting shall be reinforced with an industrial polypropylene netting with 3/4 inch spacing and shall also include a heavy duty nylon top support cord.
- B. Fence Supports
1. 2 inch x 2 inch wooden posts 3 feet long or equivalent.
 2. Field constructed.
 3. Factory pre-assembled with support netting and heavy duty nylon top support cord.

PART 3 – EXECUTION

3.01 GENERAL

- A. Except if otherwise directed or otherwise shown on the Construction Plans, provide nonwoven geotextile filter fabric silt fences to prevent erosion and control sedimentation.
- B. Maintain silt fences until the project is accepted by the Owner.
- C. At Owner's option, silt fences may remain in place after acceptance.

3.02 CONSTRUCTION METHODS

- A. Silt fences shall not exceed 24 inches in height.
- B. Wood posts shall be driven at least 12 inches into the ground.
- C. Maximum spacing of wood posts shall be 3 feet for field constructed fences and 8 feet for factory pre-assembled silt fences.

- D. Filter fabric shall be stapled using at least 1/2 inch staples to the upslope side of the posts.
- E. Anchor the filter fabric by spreading at least 8 inches of the fabric in a 4 inch by 4 inch trench or a 4 inch deep V-trench on the upslope side of the fence.

END OF SECTION

SECTION 02139

**CONSTRUCTION AND MAINTENANCE OF EROSION AND
SEDIMENTATION CONTROL SYSTEMS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This specification describes construction and maintenance of erosion and sedimentation systems control and its components.
- B. This specification indicates, in general, the location and extent of the components of erosion and sedimentation systems.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 GENERAL

- A. No clearing and grubbing or rough cutting, other than as specifically directed by the Owner to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems are in place.
- B. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way, easements, or areas for construction.
- C. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.
- D. Conduct all construction operation under this Contract in conformance with the erosion control practices described in this Specification.

3.02 EROSION AND SEDIMENTATION CONTROL SYSTEMS REQUIRED FOR
CONSTRUCTION OF WATER, SEWER, AND DRAINAGE IMPROVEMENTS

- A. Storm Sewers
 - 1. Inlet protection barriers shall be constructed using either a nonwoven geotextile filter fabric silt fence or a straw bale silt fence.

**CONSTRUCTION AND MAINTENANCE OF
EROSION AND SEDIMENTATION CONTROL SYSTEMS**

2. Inlet protection barriers shall be constructed immediately around each completed or partially completed storm manhole or inlet.
 3. Contractor shall not leave any storm manhole or inlet unprotected overnight.
- B. Sanitary Sewers
1. Under no circumstances shall unfiltered runoff entering the sanitary sewer system during construction enter any of the existing sanitary sewer system.
 2. Do not discharge water and sediment removed from any parts of a partially constructed or unaccepted sanitary sewer system directly into the storm sewer system, unprotected swales or unprotected ditches.
 3. Discharge water and sediment into the storm sewer system upstream of inlet protection barriers.
- C. Water Distribution System
1. Direct water used to blow off the system to nearby inlets upstream of inlet protection barriers.
 2. Do not direct water used to blow off the system to existing unprotected swales or unprotected ditches.
- D. Place silt fences on the construction site as shown on the Construction Plans or when directed by the Owner.
- E. Compact top layer of any stockpiled excavated material that is to be left overnight.
- F. Trash pumps shall not discharge directly to any unprotected swale, unprotected ditch or unprotected low lying area.
- G. Trash pumps shall discharge upstream of inlet protection barriers or silt fences.
- H. Contractor shall inspect the erosion and sedimentation control system after each rain, daily during periods of prolonged rainfall, and at a minimum once a week.
- I. When damage is discovered, Contractor shall repair or replace damaged components of the erosion and sedimentation control system immediately.
- J. Contractor shall remove sediment deposits when the sediment has accumulated to one-half the height of any area along any silt fence.

**CONSTRUCTION AND MAINTENANCE OF
EROSION AND SEDIMENTATION CONTROL SYSTEMS**

- K. Cast and spread sediment deposits within the limits of the construction site as directed by the Owner.
- L. WS&D contractor shall place erosion control measures at back of curb and on all disturbed areas immediately upon paving contractor's completion of placement of pavement, curb, and final lot grading.

3.03 **EROSION AND SEDIMENTATION CONTROL SYSTEMS REQUIRED FOR
CONSTRUCTION OF PAVING IMPROVEMENTS**

- A. Inlet protection barriers and silt fence constructed by the WS&D contractor shall be accepted for maintenance by the paving contractor prior to commencing any other construction activities.
- B. Trash pumps shall not discharge directly to any unprotected swale, unprotected ditch, or unprotected low lying area.
- C. Trash pumps shall discharge upstream of inlet protection barriers or silt fences.
- D. Before concrete pavement is placed and curb is completed, all previously constructed inlet protection barriers may be adjusted by the paving contractor.
- E. Storm manholes and inlets shall not be left overnight without inlet protection barriers before placement of concrete pavement and curb is completed.
- F. Contractor shall inspect the erosion and sedimentation control system after each rain, daily during prolonged rainfall, and at a minimum of once a week.
- G. When damage is discovered, Contractor shall repair or replace damaged components of the erosion and sedimentation control system immediately.
- H. Contractor shall remove sediment deposits when the sediment has accumulated to one-half the height of any area along any silt fence.
- I. Cast and spread sediment deposits within the limits of the construction site as directed by the Owner.

3.04 **MAINTENANCE**

- A. Unless otherwise directed by the Owner, the WS&D contractor is responsible for maintenance of the erosion and sedimentation control system until final acceptance of the WS&D.

**CONSTRUCTION AND MAINTENANCE OF
EROSION AND SEDIMENTATION CONTROL SYSTEMS**

- B. The WS&D contractor shall walk through the project with the paving contractor and the Engineer, and together the 3 parties will observe each component of the erosion and sedimentation control system and agree that either:
 - 1. Each component in the system is acceptable and the paving contractor will assume maintenance responsibilities, or
 - 2. List repairs the WS&D contractor must make to each component that is not acceptable before the paving contractor will assume maintenance responsibilities.
- C. When the paving contractor receives notice to proceed, he is then responsible for maintaining the erosion and sedimentation control system put in place by the WS&D contractor until completion of the placement of pavement, curb, and final lot grading.
- D. Upon completion of the placement of pavement, curb, and final lot grading by the paving contractor, the WS&D contractor shall be responsible for placement of final erosion control measures and maintenance of all erosion and sedimentation control.
- E. The WS&D contractor shall continue maintenance of the erosion and sedimentation control system until final acceptance by the Owner.

3.05 DUST CONTROL

- A. Control dust blowing and movement on construction sites and roads to prevent exposure of soil surfaces, to reduce on and offsite damage, to prevent health hazards, and to improve traffic safety.
- B. Control dust blowing by utilizing one or more of the following methods.
 - 1. Mulches bound with chemical binders such as Curasol, Terratack, or equal.
 - 2. Temporary vegetative cover.
 - 3. Spray-on adhesives on mineral soils when not used by traffic.
 - 4. Tillage to roughen surface and bring clods to the surface.
 - 5. Irrigation by water sprinkling.
- C. Dust control methods shall be implemented immediately whenever dust can be observed blowing on the project site.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 – G E N E R A L

1.01 SCOPE

- A. This section provides for furnishing all labor, materials, equipment, power and incidentals, and for performing all operations necessary to dewater and drain excavations and foundation beds as described herein.

PART 2 – P R O D U C T S

2.01 WELL POINTS

- A. Conventional vacuum type
- B. Internal sumps and pumps

2.02 OVER EXCAVATION OF TRENCH

- A. Washed shell
- B. A well graded gravel or crushed limestone meeting the requirements of ASTM C33 gradation 67 (3/4 inch to No. 4). The average wear of the aggregates shall not exceed 40%. The test for abrasion shall be by use of the Los Angeles abrasion machine as per ASTM C131.

PART 3 – E X E C U T I O N

3.01 DEWATERING

- A. Dewatering shall be required when the ground water level is less than 2 feet below the bottom of the excavation and when approved by the Engineer.

3.02 WELL POINTS

- A. Dig test holes when requested by Engineer to determine the limits of the well point system.
- B. Lower the ground water level to not less than 3 feet below the bottom of the excavation.

- C. Operate well points for at least 24 hours before excavating.
- D. Install and operate well points only if sand or silt is not produced.
- E. Contractor shall be responsible for any damage to adjacent improvements or structures resulting from the installation and operation of well points.
- F. All combustion type engine drivers shall have a mufflered exhaust system to reduce noise.
- G. Combustion type engine drivers shall be located as far from existing homes or businesses as practical.
- H. Operate well points at least 24 hours after back filling excavations.

3.03 OVER EXCAVATION OF TRENCH

- A. Excavate trench an additional 6 inches deeper than depth specified.
- B. Washed shell (or well graded gravel or crushed limestone) wrapped entirely within an approved non-woven geotextile material shall be placed in the trench, 12 inches below and directly under the pipe, in lieu of the specified bedding material.
- C. Bed the pipe above the washed shell as shown and specified.
- D. Operate a pump downstream from excavations as required to maintain an acceptable water level during trenching, bedding and back filling of pipe.

END OF SECTION

SECTION 02215

EXCAVATING, TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work under this specification covers excavating, trenching and backfilling for storm sewers, water distribution mains, sanitary sewer force mains, sanitary sewers and other utility systems and appurtenances.
- B. Shoring will be required for all excavation at depths over 5 feet.

1.02 QUALITY ASSURANCE

- A. If during progress of work, tests indicate that compacted materials do not pass specified requirements, work shall be removed, replaced and retested at no cost to Owner.
- B. Field moisture/density tests will be performed for each lift of bedding and backfill material at intervals of 500 feet measured along the trench centerline, and or at least one point between all manholes, whichever is more frequent, unless specified otherwise on the Construction Plans or unless otherwise directed by the Engineer.

PART 2 PRODUCTS

2.01 CEMENT STABILIZED SAND BEDDING AND BACKFILL

- A. Prepare and compact cement stabilized sand bedding and backfill as specified in the Technical Specification entitled "CEMENT STABILIZED SAND."

2.02 BANK SAND BEDDING AND BACKFILL

- A. Obtain bank sand from an approved source.
- B. Use sand that is free from clay lumps, organic and other deleterious material, and that has a plasticity index of 4 or less.
- C. Compact bank sand bedding and backfill in layers not thicker than 12 inches.
- D. Adjust moisture content of material to between 2% above or below optimum moisture content and compact to 95% Standard Proctor Density, ASTM D698 unless otherwise

specified on the Construction Plans.

2.03 EARTH BEDDING AND BACKFILL

- A. Suitable excavated material free of large chunks or clods.
- B. Compact earth bedding and backfill in layers not thicker than 12 inches.
- C. Adjust moisture content of material to between 2% above or below optimum moisture content and compact to 95% Standard Proctor Density, ASTM D698 unless otherwise specified on the Construction Plans.

2.04 TRENCH SHORING

A. Materials

- 1. Timber trench sheeting materials to be minimum of two inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.
- 2. Steel sheet piling shall conform to one of the following specifications:
 - a. ASTM A328;
 - b. ASTM A572, Grade 50; or
 - c. ASTM A690
- 3. Steel for stringers and cross braces shall conform to ASTM A588.

B. Trench Boxes

- 1. Portable trench boxes shall be constructed of steel conforming to ASTM Specification A-36.
- 2. Connecting bolts used shall conform to ASTM A-307.
- 3. Welds are to conform to requirements of AWS Specification D1.1.

PART 3 EXECUTION

3.01 EXCAVATION

A. Procedure

1. Excavate to indicated or specified depths.
2. During excavation, pile material suitable for backfilling in an orderly manner far enough from the bank of the trench to avoid overloading, slides or cave-ins.
3. Remove and dispose of, as indicted or directed, all excavated materials not required or suitable for backfill.
4. Grade as necessary to prevent surface water from flowing into trenches or other excavations.
5. Remove any water accumulating in trenches or other excavations, using pumping or other approved means.
6. Excavate by open cut with trenching machine or back hoe.
7. Where machines other than ladder or wheel type trenching machines are used, do not use excavated material composed of large chunks or clods for backfill, but dispose of such material and provide other suitable material for backfill without additional expense.

B. Trench Excavation

1. Trenches for pipe sewers and sanitary sewer force mains smaller than 30 inches in diameter shall have a width below the top of pipe bell or other joint of not less than the outside diameter of the pipe plus 12 inches and not more than the outside diameter of the pipe plus 18 inches.
2. Trenches for pipe sewers 30 inches in diameter and larger shall have a width below the top of pipe of not less than the outside diameter of the pipe plus 16 inches and shall be wide enough to permit making up of joints but shall not be wider than the outside diameter of the pipe plus 24 inches.
3. Trenches for water lines and sanitary sewer force mains shall have a minimum of 6 inches of space between pipe and wall of trench.
4. Remove stones as necessary to avoid point-bearing.

5. Over excavate wet or unstable soil from the trench bottom to permit construction of a more stable bed for pipe.
6. Do not over excavate.
7. Accurately grade the trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along its entire length except where necessary to excavate for pipe bell.
8. Dig bell holes and depressions for joints after the trench bottom has been graded.
9. Make bell holes and depressions for joints no deeper, longer or wider than needed to make the joint properly.

C. Trench Safety System

1. Install in sewer trenches and other excavations sheeting and bracing necessary to support the sides.
2. Sheeting is required as specified by OSHA.
3. Timber Sheeting
 - a. Install in accordance with OSHA Standards.
 - b. Drive timber sheeting to depth below trench bottom.
 - c. Size of uprights, stringers, and cross bracing to be in accordance with OSHA requirements.
 - d. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling or kickouts.
4. Steel Sheet Piling
 - a. Steel sheet piling of equal or greater strength may be substituted for timber trench shoring.
 - b. Contractor shall provide written certification that steel sheet piling substituted provides protection equal to or greater than timber trench shoring.
 - c. Steel sheet piling systems shall be designed by a Professional Engineer registered in the State of Texas.

- d. Drive steel sheet piling to minimum depth below trench bottom as recommended by Contractor's Professional Engineer providing design.
 - e. Place cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling, or kickouts.
5. Portable Trench Box
- a. A portable trench box of equal or greater strength may be substituted for timber trench shoring.
 - b. Contractor shall provide written certification that the trench box substituted provides protection equal to or greater than timber trench shoring.
 - c. Certification of trench box shall be provided by a Professional Engineer registered in the State of Texas.
 - d. In cases where top of portable trench box will be below top of trench, the trench must be sloped to the appropriate angle of repose for the existing soil conditions.
 - e. In areas where sloped trench will affect the integrity of existing structures, Contractor shall protect structures prior to sloping trench.
6. Trench Jacks
- a. Trench jacks may be used in lieu of cross bracing or stringers.
 - b. Contractor shall provide written certification that the trench jacks substituted provide protection equal to or greater than timber cross bracing or stringers.
 - c. Certification shall be provided by a Professional Engineer registered in the State of Texas.
- D. Sanitary Sewer Bedding for Dry Stable Trench
- 1. Accurately grade the bottom of the trench 6 inches below the bottom of the pipe and to the width specified unless otherwise shown on the Construction Plans.
 - 2. Place and compact at least 6 inches of cement stabilized sand bedding in the bottom of the trench unless otherwise shown on the Construction Plans.

3. Install the pipe and place and compact additional cement stabilized sand bedding to a height of 12 inches above the top of the pipe unless otherwise shown on the Construction Plans.
 4. All types of PVC pipe, flexible and semi rigid pipe used for sanitary sewer gravity lines shall be constructed using Sanitary Sewer Bedding for Dry Stable Trench unless otherwise noted on the Construction Plans.
- E. Water Line Bedding and Sanitary Sewer Force Main Bedding
1. Accurately grade the bottom of the trench 6 inches below the elevation of the normal pipe installation and to the width specified.
 2. Place and compact at least 6 inches of bank sand bedding in the bottom of the trench.
 3. Install the pipe and place and compact additional bank sand bedding to a height of 6 inches above the top of the pipe.
 4. All sanitary sewer force mains shall be constructed using the bedding described above unless otherwise indicated on the Construction Plans.
- F. Storm Sewer Bedding
1. 36 Inch Diameter and Less
 - a. Accurately grade the bottom of the trench 10 inches below the bottom of the pipe and to the width specified.
 - b. Place and compact at least 10 inches of cement stabilized sand bedding in the bottom of the trench.
 - c. Install the pipe and place and compact additional cement stabilized sand bedding to a height of 6 inches above the top of the pipe.
 - d. The Engineer may order use of washed shell or other approved granular material in lieu of cement stabilized sand bedding.
 2. 42 Inch and Larger
 - a. Accurately grade the bottom of the trench 12 inches below the bottom of the pipe and to the width specified.

- b. Place and compact at least 12 inches of cement stabilized sand for 42" and larger diameter pipe in the bottom of the trench.
- c. Install the pipe and place and compact additional cement stabilized sand bedding to a height of 6 inches above the top of the pipe.
- d. The Engineer may order use of washed shell or other approved granular material in lieu of cement stabilized sand bedding.

3.02 UTILITY INSTALLATION

A. Sanitary Sewers and Storm Sewers

- 1. Cut trench as described in Section 3.01,B.
- 2. Above the pipe, cut as wide as necessary to sheet and brace and properly perform the work.
- 3. Provide bedding as described in Section 3.01,D. and F. above.

B. Water Lines

- 1. Grade trenches to avoid high points requiring vacuum and relief valves in water lines.
- 2. Provide minimum cover over top of the pipe shown on drawings.
- 3. Avoid interference with other utilities.

C. Excavation of Appurtenances

- 1. Excavate sufficiently for manholes and similar structures to leave at least 2 feet clear between the outer surfaces and the embankment or timber that may be used to hold and protect the banks.
- 2. Any over-depth excavation below such appurtenances not directed will be considered unauthorized and will be backfilled with sand, gravel, cement stabilized sand, or concrete, as directed at no additional cost.

3.03 PROTECTION OR REMOVAL OF UTILITY LINES

- #### A. Existing utility lines shown on the Construction Plans or known to the Contractor prior to excavation and that are to be retained, as well as utility lines encountered during excavation operations must be carefully protected and satisfactorily repaired, if damaged.

- B. Any damage to lines not shown should be reported immediately.
- C. When utility lines that are to be removed are encountered, notify the Engineer so that measures can be taken to avoid interruption of service.

3.04 BACKFILL

A. Remove Shoring

1. All shoring shall be removed
2. Removal of shoring shall be in accordance with OSHA standards to maintain trench safety.
3. Bed pipe to the point specified above top of pipe prior to removal of any portion of trench safety system.
4. Backfilling and removal of trench supports shall progress together from bottom of trench upward.
5. Do not remove braces or trench supports until all personnel have evacuated the trench.
6. Backfill trench to within 5 feet of natural ground prior to removal of entire trench safety system.

B. Open Areas

1. Use earth backfill material in all trenches in open areas unless otherwise shown or specified on the Construction Plans.
2. Take special care not to damage pipe wrapping or coating.

C. Pavement Sections

1. Backfill and compact sanitary sewer and storm sewer trenches with cement stabilized sand unless otherwise shown or specified on the Construction Plans.
2. Cure cement stabilized sand at least 3 days before placing pavement on top of it.

3. Place and compact cement stabilized sand to within one foot of finished pavement surface.
4. Backfill water line trenches with the material specified on the Construction Plans.

END OF SECTION

SECTION 02215

EXCAVATING, TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work under this specification covers excavating, trenching and backfilling for storm sewers, water distribution mains, sanitary sewer force mains, sanitary sewers and other utility systems and appurtenances.
- B. Shoring will be required for all excavation at depths over 5 feet.

1.02 REFERENCE STANDARD

- A. City of Sugar Land Design Standards, dated June 2007 and all applicable amendments.

1.03 QUALITY ASSURANCE

- A. If during progress of work, tests indicate that compacted materials do not pass specified requirements, work shall be removed, replaced and retested at no cost to Owner.
- B. Field moisture/density tests will be performed for each lift of bedding and backfill material at intervals of 500 feet measured along the trench centerline, and or at least one point between all manholes, whichever is more frequent, unless specified otherwise on the Construction Plans or unless otherwise directed by the Engineer.

PART 2 PRODUCTS

2.01 CEMENT STABILIZED SAND BEDDING AND BACKFILL

- A. Prepare and compact cement stabilized sand bedding and backfill as specified in the Technical Specification entitled "CEMENT STABILIZED SAND."

2.02 BANK SAND BEDDING AND BACKFILL

- A. Obtain bank sand from an approved source.
- B. Use sand that is free from clay lumps, organic and other deleterious material, and that has a plasticity index of 4 or less.

- C. Compact bank sand bedding and backfill in layers not thicker than 12 inches.
- D. Adjust moisture content of material to between 2% above or below optimum moisture content and compact to 95% Standard Proctor Density, ASTM D698 unless otherwise specified on the Construction Plans.

2.03 EARTH BEDDING AND BACKFILL

- A. Suitable excavated material free of large chunks or clods.
- B. Compact earth bedding and backfill in layers not thicker than 12 inches.
- C. Adjust moisture content of material to between 2% above or below optimum moisture content and compact to 95% Standard Proctor Density, ASTM D698 unless otherwise specified on the Construction Plans.

2.04 TRENCH SHORING

A. Materials

- 1. Timber trench sheeting materials to be minimum of two inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.
- 2. Steel sheet piling shall conform to one of the following specifications:
 - a. ASTM A328;
 - b. ASTM A572, Grade 50; or
 - c. ASTM A690
- 3. Steel for stringers and cross braces shall conform to ASTM A588.

B. Trench Boxes

- 1. Portable trench boxes shall be constructed of steel conforming to ASTM Specification A-36.
- 2. Connecting bolts used shall conform to ASTM A-307.
- 3. Welds are to conform to requirements of AWS Specification D1.1.

PART 3 EXECUTION

3.01 EXCAVATION

A. Procedure

1. Excavate to indicated or specified depths.
2. During excavation, pile material suitable for backfilling in an orderly manner far enough from the bank of the trench to avoid overloading, slides or cave-ins.
3. Remove and dispose of, as indicted or directed, all excavated materials not required or suitable for backfill.
4. Grade as necessary to prevent surface water from flowing into trenches or other excavations.
5. Remove any water accumulating in trenches or other excavations, using pumping or other approved means.
6. Excavate by open cut with trenching machine or back hoe.
7. Where machines other than ladder or wheel type trenching machines are used, do not use excavated material composed of large chunks or clods for backfill, but dispose of such material and provide other suitable material for backfill without additional expense.

B. Trench Excavation

1. Trenches for pipe sewers and sanitary sewer force mains smaller than 30 inches in diameter shall have a width below the top of pipe bell or other joint of not less than the outside diameter of the pipe plus 12 inches and not more than the outside diameter of the pipe plus 18 inches.
2. Trenches for pipe sewers 30 inches in diameter and larger shall have a width below the top of pipe of not less than the outside diameter of the pipe plus 16 inches and shall be wide enough to permit making up of joints but shall not be wider than the outside diameter of the pipe plus 24 inches.
3. Trenches for water lines and sanitary sewer force mains shall have a minimum of 6 inches of space between pipe and wall of trench.
4. Remove stones as necessary to avoid point-bearing.

5. Over excavate wet or unstable soil from the trench bottom to permit construction of a more stable bed for pipe.
6. Do not over excavate.
7. Accurately grade the trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along its entire length except where necessary to excavate for pipe bell.
8. Dig bell holes and depressions for joints after the trench bottom has been graded.
9. Make bell holes and depressions for joints no deeper, longer or wider than needed to make the joint properly.

C. Trench Safety System

1. Install in sewer trenches and other excavations sheeting and bracing necessary to support the sides.
2. Sheeting is required as specified by OSHA.
3. Timber Sheeting
 - a. Install in accordance with OSHA Standards.
 - b. Drive timber sheeting to depth below trench bottom.
 - c. Size of uprights, stringers, and cross bracing to be in accordance with OSHA requirements.
 - d. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling or kickouts.
4. Steel Sheet Piling
 - a. Steel sheet piling of equal or greater strength may be substituted for timber trench shoring.
 - b. Contractor shall provide written certification that steel sheet piling substituted provides protection equal to or greater than timber trench shoring.
 - c. Steel sheet piling systems shall be designed by a Professional Engineer registered in the State of Texas.

- d. Drive steel sheet piling to minimum depth below trench bottom as recommended by Contractor's Professional Engineer providing design.
 - e. Place cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling, or kickouts.
5. Portable Trench Box
- a. A portable trench box of equal or greater strength may be substituted for timber trench shoring.
 - b. Contractor shall provide written certification that the trench box substituted provides protection equal to or greater than timber trench shoring.
 - c. Certification of trench box shall be provided by a Professional Engineer registered in the State of Texas.
 - d. In cases where top of portable trench box will be below top of trench, the trench must be sloped to the appropriate angle of repose for the existing soil conditions.
 - e. In areas where sloped trench will affect the integrity of existing structures, Contractor shall protect structures prior to sloping trench.
6. Trench Jacks
- a. Trench jacks may be used in lieu of cross bracing or stringers.
 - b. Contractor shall provide written certification that the trench jacks substituted provide protection equal to or greater than timber cross bracing or stringers.
 - c. Certification shall be provided by a Professional Engineer registered in the State of Texas.
- D. Sanitary Sewer Bedding for Dry Stable Trench
- 1. Accurately grade the bottom of the trench 6 inches below the bottom of the pipe and to the width specified unless otherwise shown on the Construction Plans.
 - 2. Place and compact at least 6 inches of cement stabilized sand bedding in the bottom of the trench unless otherwise shown on the Construction Plans.

3. Install the pipe and place and compact additional cement stabilized sand bedding to a height of 12 inches above the top of the pipe unless otherwise shown on the Construction Plans.
 4. All types of PVC pipe, flexible and semi rigid pipe used for sanitary sewer gravity lines shall be constructed using Sanitary Sewer Bedding for Dry Stable Trench unless otherwise noted on the Construction Plans.
- E. Water Line Bedding and Sanitary Sewer Force Main Bedding
1. Accurately grade the bottom of the trench 6 inches below the elevation of the normal pipe installation and to the width specified.
 2. Place and compact at least 6 inches of bank sand bedding in the bottom of the trench.
 3. Install the pipe and place and compact additional bank sand bedding to a height of 6 inches above the top of the pipe.
 4. All sanitary sewer force mains shall be constructed using the bedding described above unless otherwise indicated on the Construction Plans.
- F. Storm Sewer Bedding
1. 36 Inch Diameter and Less
 - a. Accurately grade the bottom of the trench 10 inches below the bottom of the pipe and to the width specified.
 - b. Place and compact at least 10 inches of cement stabilized sand bedding in the bottom of the trench.
 - c. Install the pipe and place and compact additional cement stabilized sand bedding to a height of 6 inches above the top of the pipe.
 - d. The Engineer may order use of washed shell or other approved granular material in lieu of cement stabilized sand bedding.
 2. 42 Inch and Larger
 - a. Accurately grade the bottom of the trench 12 inches below the bottom of the pipe and to the width specified.

- b. Place and compact at least 12 inches of cement stabilized sand for 42" and larger diameter pipe in the bottom of the trench.
- c. Install the pipe and place and compact additional cement stabilized sand bedding to a height of 6 inches above the top of the pipe.
- d. The Engineer may order use of washed shell or other approved granular material in lieu of cement stabilized sand bedding.

3.02 UTILITY INSTALLATION

A. Sanitary Sewers and Storm Sewers

- 1. Cut trench as described in Section 3.01,B.
- 2. Above the pipe, cut as wide as necessary to sheet and brace and properly perform the work.
- 3. Provide bedding as described in Section 3.01,D. and F. above.

B. Water Lines

- 1. Grade trenches to avoid high points requiring vacuum and relief valves in water lines.
- 2. Provide minimum cover over top of the pipe shown on drawings.
- 3. Avoid interference with other utilities.

C. Excavation of Appurtenances

- 1. Excavate sufficiently for manholes and similar structures to leave at least 2 feet clear between the outer surfaces and the embankment or timber that may be used to hold and protect the banks.
- 2. Any over-depth excavation below such appurtenances not directed will be considered unauthorized and will be backfilled with sand, gravel, cement stabilized sand, or concrete, as directed at no additional cost.

3.03 PROTECTION OR REMOVAL OF UTILITY LINES

- A. Existing utility lines shown on the Construction Plans or known to the Contractor prior to excavation and that are to be retained, as well as utility lines encountered during excavation operations must be carefully protected and satisfactorily repaired, if damaged.

- B. Any damage to lines not shown should be reported immediately.
- C. When utility lines that are to be removed are encountered, notify the Engineer so that measures can be taken to avoid interruption of service.

3.04 BACKFILL

A. Remove Shoring

1. All shoring shall be removed
2. Removal of shoring shall be in accordance with OSHA standards to maintain trench safety.
3. Bed pipe to the point specified above top of pipe prior to removal of any portion of trench safety system.
4. Backfilling and removal of trench supports shall progress together from bottom of trench upward.
5. Do not remove braces or trench supports until all personnel have evacuated the trench.
6. Backfill trench to within 5 feet of natural ground prior to removal of entire trench safety system.

B. Open Areas

1. Use earth backfill material in all trenches in open areas unless otherwise shown or specified on the Construction Plans.
2. Take special care not to damage pipe wrapping or coating.

C. Pavement Sections

1. Backfill and compact sanitary sewer and storm sewer trenches with cement stabilized sand unless otherwise shown or specified on the Construction Plans.
2. Cure cement stabilized sand at least 3 days before placing pavement on top of it.

3. Place and compact cement stabilized sand to within one foot of finished pavement surface.
4. Backfill water line trenches with the material specified on the Construction Plans.

END OF SECTION

SECTION 02321
CEMENT STABILIZED SAND

PART 1 – G E N E R A L

1.01 SECTION INCLUDES

- A. Cement stabilized sand material.

1.02 REFERENCES

- A. ASTM C33: Standard Specification for Concrete Aggregates (Fine Aggregate).
- B. ASTM C40: Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- C. ASTM C42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- D. ASTM C94: Standard Specification for Ready-Mixed Concrete.
- E. ASTM C123: Standard Test Method for Lightweight Pieces in Aggregate.
- F. ASTM C142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- G. ASTM C150: Specification for Portland Cement.
- H. ASTM D558: Standard Test Method for Moisture-Density Relations of Soil Cement-Mixtures.
- I. ASTM D1632: Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.
- J. ASTM D1633: Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
- K. ASTM D2487: Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- L. ASTM D2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

- M. ASTM D3665: Practice for Random Sampling of Construction Materials.
- N. ASTM D4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 SUBMITTALS

- A. Submittals shall conform to requirements of the Section titled “Submittals.”
- B. Submit proposed target cement content and production data for sand-cement mixture in accordance with the requirements of paragraph 2.03 of this Section.

1.04 DESIGN REQUIREMENTS

- A. Sand-cement mixture shall produce a minimum unconfined compressive strength of 100 pounds per square inch (“psi”) in 48 hours.
 - 1. Design will be based on strength specimens molded in accordance with ASTM D558 at a moisture content within 3% of optimum and within 4 hours of batching.
 - 2. Determine minimum cement content from production data and statistical history. Mix shall contain not less than 2 sacks of cement per ton (188 lbs per ton) of dry sand unless otherwise indicated on the Drawings.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Cement: Type I Portland cement conforming to ASTM C150.
- B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C33 and the following requirements:
 - 1. Classified as SW, SP, SW-SM, SP-SM, or SM by the United Soil Classification System of ASTM D2487.
 - 2. Deleterious materials:
 - a. Clay lumps, ASTM C142; less than 0.5%.
 - b. Lightweight pieces, ASTM C123; less than 5%.
 - c. Organic impurities, ASTM C40; color no darker than the standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D4318.

C. Water: Potable water, free of oils, acids, alkalis, organic matter or other deleterious substances, meeting requirements of ASTM C94.

2.02 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in a pug mill-type mixer.

B. Stamp batch ticket at plant with time of loading. Material not placed and compacted within 4 hours after mixing shall be rejected.

2.03 MATERIAL QUALIFICATION

A. Determine the target cement content of the material as follows:

1. Obtain samples of sand-cement mixtures at the production facility representing a range of cement content consisting of at least 3 points.

2. Complete the molding of samples within 4 hours after the addition of water.

3. Perform strength tests (average of 2 specimens) at 48 hours and 7 days.

4. Perform cement content tests on each sample.

5. Perform moisture content tests on each sample.

6. Plot average 48-hour strength versus cement content.

7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings and silo pressure, if applicable.

B. Test the raw sand for the following properties at the point of entry into the pug-mill:

1. Gradation.

2. Plasticity index.

3. Organic impurities.

4. Clay lumps and friable particles.

5. Lightweight pieces.

6. Moisture content.

7. Classification.

- C. The target content may be adjusted if statistical history so indicates. For determination of minimum product performance use the formula:

$$f'_c + 1/2 \text{ standard deviation}$$

PART 3 – EXECUTION

3.01 PLACING

- A. Place sand-cement mixture in a maximum 12-inch thick loose lift and compact to 95% percent of ASTM D558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. The target moisture content during compaction is plus or minus 3% of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at the plant.
- B. Do not place or compact sand-cement mixture in standing or free water.

3.02 FIELD QUALITY CONTROL

- A. Samples of delivered product will be taken in the field at point of delivery for testing in accordance with ASTM D3665.
- B. Four specimens shall be prepared and molded (for each sample obtained) in accordance with ASTM D558, Method A, without adjusting the moisture content. Samples will be molded at approximately the same time the material is being used, but no later than 4 hours after water is added to mix.
- C. After molding, specimens will be removed from the molds and sealed in a plastic bag or similar material to minimize moisture loss. Specimens will be cured at a room temperature between 60 and 80°F, until ready for testing.
- D. Specimens will be tested for compressive strength in accordance with ASTM D1633, Method A. 2 specimens will be tested at 48 hours plus or minus 2 hours and 2 specimens will be tested at 7 days plus or minus 4 hours.
- E. A strength test will be the average of the strengths of 2 specimens molded from the same sample of material and tested at the same age. The average daily strength will be the average of the strengths of all specimens molded during one day's production and tested at the same age.

- F. Precision and Bias: Test results shall meet the recommended guideline for precision in ASTM D1633, Section 9.
- G. Reporting: Test reports shall contain, as a minimum, the following information:
 - 1. Supplier and plant number.
 - 2. Time material was batched.
 - 3. Time material was sampled.
 - 4. Test age (exact hours).
 - 5. Average 48-hour strength.
 - 6. Average 7-day strength.
 - 7. Specification section number.
 - 8. Compliance/non-compliance.
 - 9. Mixture identification.
 - 10. Truck and ticket numbers.
 - 11. The time of molding.
 - 12. Moisture content at time of molding.
 - 13. Required strength.
 - 14. Test method designations.
 - 15. Compressive strength data as required by ASTM D1633.

3.03 ACCEPTANCE

- A. The strength level of the material will be considered satisfactory if:
 - 1. the average 48-hour strength is greater than 100 psi with no individual strength test below 60 psi, or
 - 2. all 7-day individual strength tests exceed 100 psi.

- B. The material will be considered acceptable for partial payment if any 7-day individual strength test (average of 2 specimens) is less than 100 psi but greater than 60 psi.
- C. The material will be considered unacceptable and subject to removal and replacement at the Contractor's expense if any individual strength test has a 7-day strength less than 60 psi.
- D. If the moving average of any 3 daily 48-hour averages falls below 100 psi, the supplier shall discontinue shipment to the project until that plant is capable of producing a material which exceeds 100 psi at 48 hours. A total of 5 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.
- E. The testing laboratory shall notify the Contractor, Engineer, and material supplier by facsimile of all tests indicating results falling below specified strength requirements.

- END OF SECTION -

SECTION 03211
REINFORCING STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Structural concrete reinforcement and grouting of reinforcement dowel bars into hardened concrete.

1.02 REFERENCES

- A. ACI 315 - Details and Detailing of Concrete Reinforcement.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- C. ASTM A36 - Standard Specification for Carbon Structural Steel.
- D. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- E. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- F. ASTM A497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete Reinforcement.
- G. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- H. ASTM A675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
- I. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- J. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- K. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- L. WRI - Manual of Standard Practice for Welded Wire Fabric.
- M. CRSI MSP-1 - Manual of Standard Practice.

1.03 SUBMITTALS

- A. Conform to the section entitled, "SUBMITTAL."
- B. Shop Drawings:
 - 1. Submit shop drawings detailing reinforcement fabrication, bar placement location, splices, spacing, bar designation, bar type, length, size, bending, number of bars, bar support type and other pertinent information, including dimensions. Provide sufficient detail for placement of reinforcement without use of Contract Drawings. Information shall correspond directly to data listed on bill of materials.
 - 2. Use of reproductions of Contract Drawings by Contractor, Subcontractor, erector, fabricator or material supplier in preparation of shop drawings (or in lieu of preparation of shop drawings).
 - 3. Detail shop drawings in accordance with ACI 315, Figure 6.
 - 4. Submit shop drawings showing location of proposed additional construction joints as required under the section entitled, "CONCRETE STRUCTURES," and obtain approval of Engineer, prior to submitting reinforcing steel shop drawings.
- C. Bill of Materials: Submit with shop drawings.
- D. Product Data:
 - 1. Mechanical Bar Splices: Submit manufacturer's technical literature, including specifications and installation instructions.
 - 2. Epoxy grout proposed for anchoring reinforcing dowels to hardened concrete: Submit manufacturer's technical literature including recommended installation procedures.
- E. Certificates:
 - 1. Submit steel manufacturer's certificates of mill tests giving properties of steel proposed for use. List manufacturer's test number, heat number, chemical analysis, yield point, tensile strength and percentage of elongation. Identify proposed location of steel in work.
 - 2. Foreign-manufactured reinforcing bars shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Submit test reports for review. Do not begin fabrication of reinforcement until material has been

approved.

1.04 HANDLING AND STORAGE

- A. Store steel reinforcement above ground on platforms, skids or other supports. Protect reinforcing from mechanical injury, surface deterioration and formation of excessive, loose or flaky rust caused by exposure to weather. Protect epoxy-coated reinforcing from formation of any amount of rust.

1.05 QUALITY ASSURANCE

- A. Notify Resident Project Representative at least 48 hours before concrete placement so that reinforcement may be inspected, and errors corrected, without delaying Work.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Reinforcing Bars: Deformed bars conforming to ASTM A615, grade as indicated on Drawings, except column spirals and those shown on Drawings to be smooth bars. Where grade is not shown on Drawings, use Grade 60.
- B. Smooth Bars: Where indicated on Drawings, use smooth bars conforming to ASTM A36; ASTM A615, Grade 60; or ASTM A675, Grade 70.
- C. Column Spirals: Bars conforming to ASTM A615, Grade 60, or wire conforming to ASTM A82.
- D. Epoxy-Coated Deformed Bars, Column Spirals and Smooth Bars: Conform to ASTM A775/A775M.
- E. Welded Wire Fabric:
 - 1. Welded Smooth Wire Fabric: Conform to ASTM A185.
 - 2. Welded Deformed Wire Fabric: Conform to ASTM A497.
 - 3. Provide wire size, type and spacing as shown. Where type is not shown on Drawings, use welded smooth wire fabric.
 - 4. Furnish welded wire fabric in flat sheets only.

- F. Tie Wire: 16-1/2 gage or heavier annealed steel wire. Use plastic-coated tie wire with epoxy-coated reinforcing steel.
- G. Bar Supports: Provide chairs, riser bars, ties and other accessories made of plastic or metal, except as otherwise specified. Use bar supports and accessories of sizes required to provide required concrete cover. Where concrete surfaces are exposed to weather, water or wastewater, provide plastic accessories only; do not use galvanized or plastic-tipped metal in such locations. Provide metal bar supports and accessories rated Class 1 or 2 conforming to CRSI MSP-1 Manual of Standard Practice. Use epoxy-coated bar supports with epoxy-coated reinforcing bars.
- H. Slabs on Grade: Provide chairs with sheet metal bases or provide precast concrete bar supports 3 inches wide, 6 inches long, and thick enough to allow required cover. Embed tie wires in 3-inch by 6-inch side.
- I. Mechanical Bar Splices:
 - 1. Conform to ACI 318; use where indicated on Drawings.
 - a. Compression splices shall develop ultimate stress of reinforcing bar.
 - b. Tension splices shall develop 125 percent of minimum yield point stress of reinforcing bar.
 - 2. Regardless of chemical composition of steel, any heat effect shall not adversely affect performance of reinforcing bar.
- J. Welded Splices:
 - 1. Provide welded splices where shown and where approved by the Engineer. Welded splices of reinforcing steel shall develop a tensile strength exceeding 125 percent of the yield strength of the reinforcing bars connected.
 - 2. Provide materials for welded splices conforming to AWS D1.4.
- K. Epoxy Grout: High-strength rigid epoxy adhesive, conforming to ASTM C881, Type IV, manufactured for purpose of anchoring dowels into hardened concrete and the moisture condition, application temperature and orientation of the hole to be filled. Unless otherwise shown, depth of embedment shall be as required to develop the full tensile strength (125 percent of yield strength) of dowel, but not less than 12 diameters.

2.02 FABRICATION

- A. Bending: Fabricate bars to shapes indicated on Drawings by cold bending. Bends shall

conform to minimum bend diameters specified in ACI 318. Do not straighten or rebend bars. Fabricate epoxy-coated reinforcing steel to required shapes in a manner that will not damage epoxy coating. Repair any damaged epoxy coating with patching material conforming to Item 4.4 of ASTM A775/A775M.

B. Splices:

1. Locate splices as indicated on Drawings. Do not locate splices at other locations without approval of Engineer. Use minimum number of splices located at points of minimum stress. Stagger splices in adjacent bars.
2. Length of lap splices: As shown on Drawings.
3. Prepare ends of bars at mechanical splices in accordance with splice manufacturer's requirements.

C. Construction Joints: Unless otherwise shown, continue reinforcing through construction joints.

D. Bar Fabrication Tolerances: Conform to tolerances listed in ACI 315, Figures 4 and 5.

E. Standard Hooks: Conform to the requirements of ACI 318.

F. Marking: Clearly mark bars with waterproof tags showing number of bars, size, mark, length and yield strength. Mark steel with same designation as member in which it occurs.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean reinforcement of scale, loose or flaky rust and other foreign material, including oil, mud or coating that will reduce bond to concrete.

3.02 INSTALLATION

- A. Placement Tolerances: Place reinforcement within tolerances of Table 03211A at the end of this Section. Bend tie wire away from forms to maintain the specified concrete coverage.
- B. Interferences: Maintain 2-inch clearance from embedded items. Where reinforcing interferes with location of other reinforcing steel, conduit or embedded items, bars may be moved within specified tolerances or one bar diameter, whichever is greater. Where

greater movement of bars is required to avoid interference, notify Engineer. Do not cut reinforcement to install inserts, conduit, mechanical openings or other items without approval of Engineer.

- C. Concrete Cover: Provide clear cover measured from reinforcement to face of concrete as listed in Table 03211B at the end of this Section, unless otherwise indicated on Drawings.
- D. Placement in Forms: Use spacers, chairs, wire ties and other accessory items necessary to assemble, space and support reinforcing properly. Provide accessories of sufficient number, size and strength to prevent deflection or displacement of reinforcement due to construction loads or concrete placement. Use appropriate accessories to position and support bolts, anchors and other embedded items. Tie reinforcing bars at each intersection, and to accessories. Blocking reinforcement with concrete or masonry is prohibited.
- E. Placement for Concrete on Ground: Support bar and wire reinforcement on chairs with sheet metal bases or precast concrete blocks spaced at approximately 3 feet on centers each way. Use minimum of one support for each 9 square feet. Tie supports to reinforcing bars and wires.
- F. Vertical Reinforcement in Columns: Offset vertical bars by at least one bar diameter at splices. Provide accurate templates for column dowels to ensure proper placement.
- G. Splices:
 - 1. Do not splice bars, except at locations indicated on Drawings or reviewed shop drawings, without approval of Engineer.
 - 2. Lap Splices: Unless otherwise shown or noted, Class B, conforming to ACI 318, Section 12.15.1. Tie securely with wire prior to concrete placement, to prevent displacement of splices during concrete placement.
 - 3. Mechanical Bar Splices: Use only where indicated on Drawings or approved by the Engineer. Install in accordance with manufacturer's instructions.
 - a. Couplers located at a joint face shall be of a type which can be set either flush or recessed from the face as shown. Seal couplers prior to concrete placement to completely eliminate concrete or cement paste from entering.
 - b. Couplers intended for future connections: Recess 1/2 inch minimum from concrete surface. After concrete is placed, plug coupler and fill recess with sealant to prevent contact with water or other corrosive materials.

- c. Unless noted otherwise, match mechanical coupler spacing and capacity to that shown for the adjacent reinforcing.
- H. Construction Joints: Place reinforcing continuous through construction joints, unless noted otherwise.
- I. Welded Wire Fabric: Install wire fabric in as long lengths as practicable. Unless otherwise indicated on Drawings, lap adjoining pieces at least 6 inches or one full mesh plus 2 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps. Conform to WRI - Manual of Standard Practice for Welded Wire Fabric.
- J. Field Bending: Shape reinforcing bent during construction operations to conform to Drawings. Bars shall be cold-bent; do not heat bars. Closely inspect reinforcing for breaks. When reinforcing is damaged, replace, Cadweld, or otherwise repair, as directed by Engineer. Do not bend reinforcement after it is embedded in concrete.
- K. Epoxy-coated Reinforcing Steel: Install in accordance with paragraph 3.02J, Field Bending, and in a manner that will not damage epoxy coating. Repair damaged epoxy coating with patching material as specified in paragraph 2.02A, Bending.
- L. Field Cutting: Cut reinforcing bars by shearing or sawing. Do not cut bars with cutting torch.
- M. Welding of reinforcing bars is prohibited, except where shown on Drawings.

3.03 GROUTING OF REINFORCING AND DOWEL BARS

- A. Use epoxy grout for anchoring reinforcing and dowel steel to existing concrete in accordance with epoxy manufacturer's instructions. Drill hole not more than 1/4 inch larger than steel bar diameter (including height of deformations for deformed bars) in existing concrete. Just before installation of steel, blow hole clean of all debris using compressed air. Partially fill hole with epoxy, using enough epoxy so when steel bar is inserted, epoxy grout will completely fill hole around bar. Dip end of steel bar in epoxy and twist bar while inserting into partially-filled hole.

Table 03211A

REINFORCEMENT PLACEMENT TOLERANCES

PLACEMENT	TOLERANCE IN INCHES
Clear Distance - To formed soffit: To other formed surfaces: Minimum spacing between bars:	-1/4 +/- 1/4 -1/4
Clear distance from unformed surface to top reinforcement - Members 8 inches deep or less: Members more than 8 inches deep but less than 24 inches deep: Members 24 inches deep or greater: Uniform spacing of bars (but the required number of bars shall not be reduced): Uniform spacing of stirrups and ties (but the required number of stirrups and ties shall not be reduced):	+/- 1/4 -1/4, +1/2 -1/4, +1 +/- 2 +/- 1
Longitudinal locations of bends and ends of reinforcement - General: Discontinuous ends of members: Length of bar laps:	+/- 2 +/- 1/2 -1-1/2
Embedded length - For bar sizes No. 3 through 11: For bar sizes No. 14 and 18:	-1 -2

Table 03211B
 MINIMUM CONCRETE COVER FOR REINFORCEMENT

SURFACE	MINIMUM COVER IN INCHES
Slabs and Joists - Top and bottom bars for dry conditions - No. 14 and No. 18 bars: No. 11 bars and smaller:	1-1/2 1
Formed concrete surfaces exposed to earth, water or weather; over, or in contact with, sewage; and for bottoms bearing on work mat, or slabs supporting earth cover - No. 5 bars and smaller: No. 6 through No. 18 bars:	1-1/2 2
Beams and Columns - For dry conditions - Stirrups, spirals and ties: Principal reinforcement: Exposed to earth, water, sewage or weather - Stirrups and ties: Principal reinforcement:	1-1/2 2 2 2-1/2
Walls - For dry conditions - No. 11 bars and smaller: No. 14 and No. 18 bars: Formed concrete surfaces exposed to earth, water, sewage or weather, or in contact with ground - Circular tanks with ring tension: All others:	1 1-1/2 2 2
Footings and Base Slabs - At formed surfaces and bottoms bearing on concrete work mat: At unformed surfaces and bottoms in contact with earth: Over top of piles: Top of footings -- same as slabs	2 3 2

END OF SECTION

SECTION 03310
STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place normal-weight structural concrete and mass concrete.

1.02 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304.2R - Placing Concrete by Pumping Methods
- C. ACI 305R - Hot Weather Concreting.
- D. ACI 306.1 - Standard Specification for Cold Weather Concreting.
- E. ACI 309R - Guide for Consolidation of Concrete.
- F. ACI 318 - Building Code Requirements for Reinforced Concrete.
- G. ACI 350R - Environmental Engineering Concrete Structures.
- H. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- I. ASTM C33 - Standard Specification for Concrete Aggregates.
- J. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- K. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- L. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- M. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
- N. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.

- O. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- P. ASTM C136 - Standard Test Method for Sieve Analyses of Fine and Coarse Aggregates.
- Q. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
- R. ASTM C150 - Standard Specification for Portland Cement.
- S. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
- T. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
- U. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- V. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
- W. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- X. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- Y. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
- Z. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
- AA. ASTM C 535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- BB. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.
- CC. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete.
- DD. Concrete Plant Manufacturer's Bureau (CPMB), Plant Mixer Manufacturers Division: Concrete Plant Mixer Standards.
- EE. National Ready-Mixed Concrete Association (NRMCA): Certification of Ready-Mixed Concrete Production Facilities (checklist with instructions).

FF. John Wiley and Sons, Interscience Publishers Division, "Encyclopedia of Industrial Chemical Analysis," Vol. 15, Page 230 (alkalinity test procedure)

1.03 DEFINITIONS

- A. Mass Concrete: Concrete sections 4 feet or more in least dimension.
- B. Hot Weather: Any combination of high air temperature, low relative humidity and wind velocity tending to impair quality of fresh or hardened concrete or otherwise resulting in abnormal properties.
- C. Cold Weather: Period when, for more than 2 successive days, mean daily temperature is below 40 degrees F.

1.04 SUBMITTALS

- A. Conform to the section entitled, "Submittals."
- B. Mill Certificates: Required for bulk cement.
- C. Design Mixes:
 - 1. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and shrinkage tests for Class A and D concrete at 21 or 28 days of drying.
 - 2. Submit abrasion loss and soundness test results for limestone aggregate.
 - 3. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Notice to Proceed.
 - 4. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.
 - 5. Review and acceptance of mix design does not relieve Contractor of

responsibility to provide concrete of quality and strength required by these Specifications.

- D. Admixtures: Submit manufacturer's technical information, including following:
1. Air-Entraining Admixture: Give requirements to control air content under all conditions, including temperature variations and presence of other admixtures.
 2. Chemical Admixtures: Give requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.
- E. High-range Water Reducer (Superplasticizer): When approved for use by Engineer, submit manufacturer's technical information and instructions for use of superplasticizer. Superplasticizer will not be added at ready-mix plant. When superplasticizer will be added at job site, submit proposed plan for measuring and adding superplasticizer to concrete mix at job site, and establish dosing area on site with holding tanks and metering devices. Identify portions of Work on which superplasticizer is proposed for use.
- F. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product.
- G. Project Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.

1.05 QUALITY ASSURANCE

- A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record dates, locations, quantities, air temperatures, and test samples taken.
- B. Code Requirements: Concrete construction for buildings shall conform to ACI 318. Concrete construction for water and wastewater treatment and conveying structures shall conform to ACI 318 with modifications by ACI 350R, Item 2.6. Where this Specification conflicts with ACI 318 or ACI 350R, this Specification governs.
- C. Testing and Other Quality Control Services:
1. Concrete testing required in this section, except concrete mix design, limestone

aggregate test data, and testing of deficient concrete, will be performed by an independent commercial testing laboratory employed and paid by the Owner in accordance with the section entitled, "Testing Laboratory Services."

2. Provide material for and cooperate fully with Owner's testing laboratory technician in obtaining samples for required tests.
3. Standard Services: The following testing and quality control services will be provided by Owner in accordance with the section entitled, "Testing Laboratory Services:"
 - a. Verification that plant equipment and facilities conform to NRMCA "Certification of Ready-Mix Concrete Production Facilities".
 - b. Testing of proposed materials for compliance with this Specification.
 - c. Review of proposed mix design submitted by Contractor.
 - d. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Specification.
 - e. Strength testing of concrete according to following procedures:
 - (1) Obtaining samples for field test cylinders from every 50 cubic yards and any portion less than 50 cubic yards for each mix design placed each day, according to ASTM C 172, with each sample obtained from a different batch of concrete on a representative, random basis. Selecting test batches by any means other than random numbers chosen before concrete placement begins is not allowed. In the event that a structure is completed with less than 50 cubic yards, a minimum of two random samples shall be selected for that structure.
 - (2) Molding four specimens from each sample according to ASTM C 31, and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C 31.
 - (3) Testing two specimens at 7 days and two specimens at 28 days according to ASTM C 39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days.

- f. Air content: For each strength test, determination of air content of normal weight concrete according to ASTM C 231.
- g. Slump: For each strength test, and whenever consistency of concrete appears to vary, conducting slump test in accordance with ASTM C 143.
- h. Temperature: For each strength test, checking concrete temperature in accordance with ASTM C 1064.
- i. Lightweight concrete: For each strength test, or more frequently when requested by Engineer, determination of air content by ASTM C 567 and unit weight by ASTM C 567.
- j. Monitoring of current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise Contractor to use hot weather precautions when such conditions will exist during concrete placement, and note on concrete test reports when Contractor has been advised that hot weather conditions will exist.
- k. Class A and D Concrete Shrinkage Tests: Performance of drying shrinkage tests for trial batches as follows:
 - (1) Preparation and Testing of Specimens: Compression and drying shrinkage test specimens will be taken in each case from the same concrete sample; shrinkage tests will be considered a part of the normal compression tests for the project. 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C157, modified as follows:
 - (i) Wet curing: Remove specimens from molds at an age of 23 hours “1 hour after trial batching and immediately immerse in water at 70 degrees F “3 degrees F for at least 30 minutes
 - (ii) Measure within 30 minutes after first 30 minutes of immersion to determine original length (not to be confused with “base length”);
 - (iii) Then submerge in saturated limewater, at 73 degrees F +/- 3 degrees F, for 7 days;

- (iv) Then measure at age 7 days to establish “base length” for drying shrinkage calculations (“zero” days drying age);
 - (v) Calculate expansion (base length expressed as a percentage of original length);
 - (vi) Immediately store specimens in a temperature- and humidity-controlled room maintained at 73 degrees F, +3 degrees F and 50 percent +/- 4 percent relative humidity, for the remainder of the test.
 - (vii) Measure to determine shrinkage, expressed as percentage of base length. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at zero days drying age) and the length after drying at each test age. Compute the average drying shrinkage deformation of the specimens to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen. Report results of shrinkage tests to the nearest 0.001 percent of shrinkage.
 - (viii) Report shrinkage separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
4. Additional Testing and Quality Control Services: The following will be performed by an independent commercial testing laboratory employed and paid by the Owner in accordance with the section entitled, “Testing Laboratory Services,” when requested by Engineer.
- a. Checking of batching and mixing operations.
 - (1) Review of manufacturer's report of each cement shipment and conducting laboratory tests of cement.
 - (2) Molding and testing reserve 7-day cylinders or field cylinders.
 - (3) Conducting additional field tests for slump, concrete temperature and ambient temperature.
 - (4) Alkalinity Tests: For concrete used in sanitary structures, one test for

each structure. Perform alkalinity tests on concrete covering reinforcing steel on the inside of the pipe or structure in accordance with "Encyclopedia of Industrial Chemical Analysis," Vol. 15, page 230.

5. Contractor shall provide the following testing and quality control services:
 - a. Employ an independent commercial testing laboratory, acceptable to Owner, to prepare and test design mix for each class of concrete for which material source has been changed.
 - b. Notify commercial testing laboratory employed by Owner 24 hours prior to placing concrete.
6. Testing of deficient concrete in place:
 - a. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required by Engineer.
 - b. When concrete in place proves to be deficient, Contractor shall pay costs, including costs due to delays, incurred in providing additional testing and analysis services provided by the Engineer, or the independent commercial testing laboratory selected by the Owner.
 - c. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to the Owner.
 - d. Core Tests:
 - (1) Obtain and test cores in accordance with ASTM C 42. Where concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before test; test dry. Where concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning in accordance with ASTM C 42.
 - (2) Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Location of

cores shall be determined by Engineer so as to least impair strength of structure. When, before testing, one or more cores shows evidence of having been damaged during or after removal from structure, replace the damaged cores.

- (3) Concrete in area represented by core test will be considered adequate when average strength of cores is equal to at least 85 percent of specified strength, and when no single core is less than 75 percent of specified strength.
 - (4) Patch core holes in accordance with the section entitled, "Concrete Finishing."
- e. Structural Analysis: When core tests are inconclusive or impractical to obtain, Engineer may perform additional structural analysis at Contractor's expense to confirm safety of structure.
 - f. Load Tests: When core tests and structural analysis do not confirm safety of structure, load tests may be required, and their results evaluated, in accordance with ACI 318.
 - g. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe), or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in structure, to evaluate concrete strength in place, or for selecting areas to be cored. However, such tests, unless properly calibrated and correlated with other test data, shall not be used as basis for acceptance or rejection of structure's safety.

1.06 STORAGE AND HANDLING OF MATERIALS

- A. Cement: Store cement in weather tight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set. When there is any doubt as to expansive potential of shrinkage-compensating cements because of method or length of storage and exposure, laboratory test cement before use.
- B. Aggregate: Arrange and use aggregate stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before next is started.
- C. Fine Aggregate: Before using, allow fine aggregate to drain until uniform moisture content is reached.

- D. Admixtures: Store admixtures to avoid contamination, evaporation or damage. For those used in form of suspensions or non-stable solutions, provide suitable agitating equipment to assure uniform distribution of ingredients. Protect liquid admixtures from freezing and other temperature changes which would adversely affect their characteristics.
- E. Lightweight Aggregates: Uniformly pre-dampen lightweight aggregates as necessary to prevent excessive variations in moisture content. Allow pre-dampened aggregates to remain in stockpiles, under continuous fog spray, for minimum of 24 hours before use. Provide adequate drainage in stockpile areas to eliminate excess water and accumulation of contaminated fines.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement:
 - 1. Use same brand of cement used in concrete mix design. Use only one brand of each type in each structure, unless otherwise indicated on Drawings.
 - 2. Portland Cement: ASTM C150, Type I or Type II, gray in color. Use Type III only when specifically authorized by Engineer in writing. Use Type II, including the requirements of Table 2, in construction of liquid-containing structures and cooling towers, unless shown otherwise on Drawings.
- B. Admixtures:
 - 1. Do not use calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions.
 - 2. Air-Entraining Admixtures: ASTM C260, compatible with other admixtures used.
 - 3. Chemical Admixtures: Polymer type, non-staining, chloride-free admixtures conforming to ASTM C494, Type A, C, D or E.
 - 4. High-Range Water Reducer (Superplasticizer): ASTM C494, Type F or G, compatible with and by the same manufacturer as other admixtures.
- C. Mixing Water: Use clean, potable water, free from harmful amounts of oils, acids, alkalis or other deleterious substances, meeting requirements of ASTM C94.
- D. Aggregates: Use coarse aggregate from only one source, and fine aggregate from only

one source, for exposed concrete in any single structure.

1. Coarse Aggregate: Gravel, crushed gravel or crushed limestone conforming to ASTM C33.
 2. Fine Aggregate: Natural sand complying with ASTM C33.
 3. Limestone aggregate shall conform to ASTM C33 and the following additional requirements: Clean, hard, strong and durable particles free of chemicals and coatings of silt, clay, or other fine materials that may affect hydration and bond of cement paste. Select crushed limestone: High-calcium limestone (minimum 95 percent CaCO₃ and maximum 3.5 percent MgCO₃) with maximum Los Angeles Abrasion loss of 38 percent, when tested in accordance with ASTM C131 or ASTM C535. Test aggregate for soundness in accordance with ASTM C 88; maximum loss shall not exceed 18 percent after 5 cycles of magnesium sulfate test.
 4. Maximum size of coarse aggregate:
 - a. Normal weight concrete, except as noted below: 1-1/2 inches.
 - b. Formed members 6 inches or less in least dimension: 1/5 least dimension.
 - c. Slabs: 1/3 depth of slab.
 - d. Drilled shafts: 1/3 clearance between reinforcing steel, but not greater than 3/4 inch.
 - e. Concrete fill, seal slabs and bonded concrete topping in clarifiers: 3/8 inch.
 5. Coarse aggregate for lightweight concrete: ASTM C330. Grading limits: 3/4 inch to No. 4.
 6. Abrasive Aggregate: Conform to requirements of the section entitled, "Concrete Finishing."
- E. Calcium Chloride: Not permitted.
- F. Evaporation Retardant: Masterbuilders "Confilm", Euclid "Eucobar", or equal.
- G. Miscellaneous Materials:
1. Bonding Agent: Two-component modified epoxy resin.

2. Vapor barrier: 6 mil clear polyethylene film of type recommended for below-grade application.
3. Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement and water-reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.02 CONCRETE MIX

- A. Objective: Select proportions of ingredients to produce concrete having proper placeability, durability, strength, appearance, and other specified properties.
- B. Mix Design: Employ and pay an independent commercial testing laboratory, acceptable to Owner, to prepare and test mix designs for each type of concrete specified. Proportion mix design ingredients by weight. Submit mix designs and test results for approval.
 1. During the trial batches, aggregate proportions may be adjusted by the testing laboratory using two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor. Concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractor's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. Prepare trial batches using the aggregates, cement and admixtures proposed for the project. Make trial batches large enough to obtain 3 drying shrinkage test specimens and 6 compression test specimens from each batch. Shrinkage testing is required only for Class A and D concrete.
 2. Determine compressive strength by testing 6-inch diameter by 12-inch high cylinders, made, cured and tested in accordance with ASTM C192 and ASTM C39. Test 3 compression test cylinders at 7 days and 3 at 28 days. Average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall be not less than 125 percent of the specified compressive strength.
 3. Perform sieve analysis of the combined aggregate for each trial batch according to of ASTM C136. Report percentage passing each sieve.
 4. In mix designs for Class A and D concrete, fine aggregate shall not exceed 41 percent of total aggregate by weight.
- C. Shrinkage Limitations, Class A and D Concrete

1. Maximum concrete shrinkage for specimens cast in the laboratory from the trial batch: 0.036 percent as measured at 21-day drying age, or 0.042 percent at 28-day drying age. Use for construction only mix designs that meet trial batch shrinkage requirements. Shrinkage limitations apply only to Class A and D concrete.
 2. Maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.
 3. If the required shrinkage limitation is not met during construction, take any or all of the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements: Changing the source or aggregates, cement or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or its effects.
- D. Selecting Ingredient Proportions for Concrete:
1. Proportion concrete mix according to ACI 301, Chapter 3.
 2. Establish concrete mix design by laboratory trial batches prepared by independent testing laboratory, or on basis of previous field experience in accordance with provisions of ACI 318, Item 5.3; however, minimum cement content for each class of concrete shall not be less than specified.
 3. Concrete mix design data submitted for review shall have average 28-day compressive strength calculated in accordance with ACI 318, Item 5.3.2.1. When data is not available to determine standard deviation in accordance with ACI 318, Item 5.3.1, average 28-day strength of mix design shall conform to ACI 318, Table 5.3.2.2.
- E. Water-Cement Ratios:
1. Maximum allowable water-cement ratios shall be as follows:
 - a. Concrete for liquid-containing structures: 0.45.
 - b. Concrete subjected to brackish water, salt spray or deicers: 0.40.
 - c. All other concrete: 0.55.
 2. Superplasticizer may be added to maintain specified maximum water-cement ratios. Include free water in aggregate in water-cement ratio computations.
- F. Adjustment of Mix Proportions: After sufficient data becomes available during

construction, mix may be adjusted upon approval of Engineer, in accordance with ACI 318, Item 5.5; however, minimum cement content for each class of concrete shall not be less than specified.

G. Entrained Air: Air-entrain all concrete except drilled shafts. Total air content in accordance with ASTM C173: 4 to 6 percent.

H. Consistency, Workability, and Slump:

1. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce concrete which can be worked properly into place without segregation, and which can be compacted by vibratory methods as specified, to give the desired strength, density, impermeability and smoothness of surface. Change the quantity of water as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. Determine the consistency of the concrete in successive batches by slump tests in accordance with ASTM C 143. Slumps shall be as follows:

<u>Concrete Type</u>	<u>Minimum Slump</u>	<u>Maximum Slump</u>
Portland Cement Concrete	2"	4"
Concrete to be dosed with superplasticizer	1"	3"
Normal Weight Concrete after dosing with superplasticizer	4"	9"
Lightweight Concrete after dosing with superplasticizer	4"	7"
Drilled Shaft Concrete	4" *	8"

* Minimum slump where drilled shafts are cast in temporary casings: 5 inches.

2. Specified slump shall apply at time when concrete is discharged at job site. Perform slump tests to monitor uniformity and consistency of concrete delivered to job site; however, do not use as basis for mix design. Do not exceed water-cement ratios specified.

I. Admixtures: Proportion admixtures according to manufacturer's recommendations. Use of accelerator is permitted when air temperature is less than 40 degrees F. Use of

retarder is permitted when temperature of placed concrete exceeds 65 degrees F.

J. High-Range Water Reducers (Superplasticizers): Use superplasticizer to improve workability of concrete or delay hydration of cement, in accordance with requirements and recommendations of product manufacturer and approved submittals.

K. Concrete Classification and Strength:

1. Strength: Conform to values for class of concrete indicated on Drawings for each portion of Work. Requirements are based on 28-day compressive strength. If high early-strength concrete is allowed, requirements are based on 7-day compressive strength.

2. Classification:

Minimum 28-Day		
Class (Normal Weight)	Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
Concrete for Structures Containing Water or Wastewater		
A	4000	564 (6 Sacks)
B	1500	329 (3-1/2 Sacks)
C	3000	470 (5 Sacks)
D	5000	658 (7 Sacks)
H	4500	611 (6-1/2 Sacks)

Minimum 28-Day		
Class (Normal Weight)	Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
Concrete for Buildings, Slabs on Grade and Miscellaneous Structures		

AB	4000	Not Applicable
BB	1500	Not Applicable
CB	3000	Not Applicable
DB	5000	Not Applicable

Minimum 28-Day		
Class (Light Weight)	Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
E	3000	Not Applicable
F	4000	Not Applicable
G	5000	Not Applicable

3. Maximum size aggregate for Class H concrete: 3/8 inch. Maximum size aggregate for all other normal-weight concrete: 1-1/2 inches, except as specified in Paragraph 2.01D.4.
4. When required strength is not obtained with minimum cement content as specified, add cement, lower water-cement ratio or provide other aggregates as necessary.
5. In addition to conforming to specified strength, lightweight concrete must be within specified unit weight limits. Maximum air-dry unit weight is 118 pounds per cubic foot; minimum is 110 pounds per cubic foot unless shown otherwise on Drawings. Determine air-dry unit weight in accordance with ASTM C 567. Correlate air-dry unit weight with fresh unit weight of the same concrete as a basis for acceptance during construction.

L. Use of Classes of Concrete:

1. Use classes of concrete as indicated on the Drawings and in other specifications.
2. Liquid-containing structures: If not otherwise indicated, use the following classes

for structures containing water or wastewater and for utility applications in the locations described:

- a. Class A: All reinforced concrete and where not otherwise defined.
 - b. Class B: Unreinforced concrete used for plugging pipes, seal slabs, thrust blocks and trench dams, unless indicated otherwise.
 - c. Class H: Fill and topping. Where concrete fill thickness exceeds 3 inches in the majority of a placement and is not less than 1.5 inches thick, Class A concrete may be used.
3. All other structures: If not otherwise indicated, use the following classes in the locations described:
- a. Class AB: All reinforced concrete and where not otherwise defined.
 - b. Class CB: Duct banks; see the section entitled, “Underground Duct Banks” for additional requirements.
 - c. Class BB: Unreinforced concrete fill under structures.

2.03 MIXING NORMAL WEIGHT CONCRETE

- A. Conform to ACI 301, Chapter 7.
- B. Ready-Mixed Concrete:
 1. Measure, batch, mix and transport ready-mixed concrete according to ASTM C 94. Plant equipment and facilities shall conform to NRMCA “Certification of Ready Mixed Concrete Production Facilities.”
 2. Provide batch tickets with information specified in ASTM C 94. Deliver batch ticket with concrete and give to Owner’s on-site testing laboratory representative.
- C. Batch Mixing at Site:
 1. Mix concrete in batch mixer conforming to requirements of CPMB “Concrete Plant Mixer Standards”. Use mixer equipped with suitable charging hopper, water storage tank and water measuring device. Batch mixer shall be capable of mixing

aggregates, cement and water into uniform mass within specified mixing time, and of discharging mix without segregation. Operate mixer according to rated capacity and recommended revolutions per minute printed on manufacturer's rating plate.

2. Charge batch into mixer so some water will enter before cement and aggregates. Keep water running until one-fourth of specified mixing time has elapsed. Provide controls to prevent discharging until required mixing time has elapsed. When concrete of normal weight is specified, provide controls to prevent addition of water during mixing. Discharge entire batch before mixer is recharged.
3. Mix each batch of 2 cubic yards or less for not less than 1 minute and 30 seconds. Increase minimum mixing time 15 seconds for each additional cubic yard or fraction of cubic yard.
4. Keep mixer clean. Replace pick-up and throw-over blades in drum when they have lost 10 percent of original depth.

D. Admixtures:

1. Charge air-entraining and chemical admixtures into mixer as solution using automatic dispenser or similar metering device. Measure admixture to accuracy within + 3 percent. Do not use admixtures in powdered form.
2. Two or more admixtures may be used in same concrete, provided that admixtures in combination retain full efficiency and have no deleterious effect on concrete or on properties of each other. Inject admixtures separately during batching sequence.
3. Add retarding admixtures as soon as practicable after addition of cement.

E. Temperature Control:

1. When ambient temperature falls below 40 degrees F, keep as-mixed temperature above 55 degrees F to maintain concrete above minimum placing temperature.
2. When water or aggregate has been heated, combine water with aggregate in mixer before cement is added. Do not add cement to mixtures of water and aggregate when temperature of mixture is greater than 100 degrees F.
3. In hot weather, maintain temperature of concrete below maximum placing temperature. When necessary, temperature may be lowered by cooling

ingredients, cooling mixer drum by fog spray, using chilled water or well-crushed ice in whole or part for added water, or arranging delivery sequence so that time of transport and placement does not generate unacceptable temperatures.

4. Submit hot weather and cold weather concreting plans for approval.

2.04 MIXING LIGHTWEIGHT CONCRETE

- A. Determining Absorption of Aggregates: Mixing procedures vary according to total absorption by weight of lightweight aggregates. Determine total absorption by weight before pre-dampening in accordance with ASTM C 127.
- B. Ten Percent or Less Absorption: Follow same requirements as for mixing normal-weight concrete when preparing concrete made with low-absorptive lightweight aggregates having 10 percent or less total absorption by weight. To be low-absorptive, aggregates must absorb less than 2 percent additional water in first hour after mixing.
- C. More Than 10 Percent Absorption: Batch and mix concrete made with lightweight aggregates having more than 10 percent total absorption by weight, as follows:
 1. Place approximately 80 percent of mixing water in mixer.
 2. If aggregates are pre-dampened, add air-entraining admixture and all aggregates. Mix for minimum of 30 seconds, or 5 to 10 revolutions of truck mixer.
 3. When aggregates have not been pre-dampened, mix aggregates and water for minimum of 1 minute and 30 seconds, or 15 to 30 revolutions of truck mixer. Then add air-entraining admixture and mix for additional 30 seconds.
 4. Then, in the following sequence, add specified or permitted admixtures (other than air-entraining agent), all cement, and mixing water previously withheld.
 5. Complete mixing using procedures for normal-weight concrete.

2.05 MASS CONCRETE

- A. Do not use high early-strength cement (Type III) or accelerating admixtures.
- B. Use high-range water-reducing admixture (superplasticizer) to minimize water content and cement content.
- C. Specified water-reducing retarding admixture may be required to prevent cold joints when placing large quantities of concrete, to permit re-vibration of concrete, to offset effects of high temperature in concrete or weather, and to reduce maximum temperature or rapid

temperature rise.

2.06 EQUIPMENT

- A. Select equipment of size and design to ensure continuous flow of concrete at delivery end. Conform to following equipment and operations requirements.
- B. Truck mixers, agitators and manner of operation: Conform to ASTM C 94. Use of non-agitating equipment for transporting concrete is not permitted.
- C. Belt conveyors: Configure horizontally, or at a slope causing no segregation or loss. Use approved arrangement at discharge end to prevent separation. Discharge long runs without separation into hopper.
- D. Chutes: Metal or metal-lined (other than aluminum). Arrange for vertical-to-horizontal slopes not more than 1 to 2 nor less than 1 to 3. Chutes longer than 20 feet or not meeting slope requirements may be used if concrete is discharged into hopper before distribution.
- E. Do not use aluminum or aluminum-alloy pipe or chutes for conveying concrete.

PART 3 - EXECUTION

3.01 SPECIAL CONSIDERATIONS

- A. Concreting Under Water: Not permitted except where shown otherwise on Drawings or approved by Engineer. When shown or permitted, deposit concrete under water by methods acceptable to the Engineer so fresh concrete enters mass of previously-placed concrete from within, causing water to be displaced with minimum disturbance at surface of concrete.
- B. Protection from Adverse Weather: Unless adequate protection is provided or Engineer's approval is obtained, do not place concrete during rain, sleet, snow or freezing weather. Do not permit rainwater to increase mixing water or to damage surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect Work.
- C. Existing Concrete: Where matching existing concrete, texture and finish of proposed concrete shall match the existing surface. Costs for texture and finish shall be considered subsidiary to the concrete item.

3.02 PREPARATION OF SURFACES FOR CONCRETING

- A. Earth Surfaces:

1. Under interior slabs on grade, install vapor barrier. Lap joints at least 6 inches and seal watertight with tape, or sealant applied between overlapping edges and ends. Repair vapor barrier damaged during placement of reinforcing and inserts with vapor barrier material; lap over damaged areas at least 6 inches and seal watertight.
 2. Other Earth Surfaces: Thoroughly wet by sprinkling prior to placing concrete, and keep moist by frequent sprinkling up to time of placing concrete thereon. Remove standing water. Surfaces shall be free from standing water, mud and debris at the time of placing concrete.
- B. Construction Joints:
1. Definition: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been interrupted so that, in the judgment of the Engineer, new concrete cannot be incorporated integrally with that previously placed.
 2. Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, use forms or other means to shape the working face to secure proper union with subsequent work. Make construction joints only where acceptable to the Engineer.
 3. Preparation: Give horizontal joint surfaces a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, clean joint surfaces of laitance, loose or defective concrete and foreign material by hydro-blasting or sandblasting (exposing aggregate), roughen surface to expose aggregate to a depth of at least 1/4 inch and wash thoroughly. Remove standing water from the construction joint surface before new concrete is placed.
 4. After surfaces have been prepared cover approximately horizontal construction joints with a 3-inch lift of a grout mix consisting of Class A concrete batched without coarse aggregate; place and spread grout uniformly. Place wall concrete on the grout mix immediately thereafter.
- C. Set and secure reinforcement, anchor bolts, sleeves, inserts and similar embedded items in the forms where indicated on Contract Drawings, shop drawings and as otherwise required. Obtain Engineer's acceptance before concrete is placed. Accuracy of placement is the sole responsibility of the Contractor.
- D. Place no concrete until at least 4 hours after formwork, inserts, embedded items, reinforcement and surface preparation have been completed and accepted by the Resident Project Representative. Clean surfaces of forms and embedded items that have become

encrusted with grout or previously-placed concrete before placing adjacent concrete.

- E. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), thoroughly clean and roughen the surface of the old concrete by hydro-blasting or sandblasting (exposing aggregate). Coat joint surface with epoxy bonding agent following manufacturer's written instructions, unless indicated otherwise. Unless noted otherwise, this provision does not apply to vertical wall joints where waterstop is installed.
- F. Protection from Water: Place no concrete in any structure until water entering the space to be filled with concrete has been properly cut off or diverted and carried out of the forms, clear of the work. Deposit no concrete underwater. Do not allow still water to rise on any concrete until concrete has attained its initial set. Do not allow water to flow over the surface of any concrete in a manner and at a velocity that will damage the surface finish of the concrete. Pumping, dewatering and other necessary operations for removing ground water, if required, are subject to Resident Project Representative review.
- G. Corrosion Protection: Position and support pipe, conduit, dowels and other ferrous items to be embedded in concrete construction prior to placement of concrete so there is at least a 2 inch clearance between them and any part of the concrete reinforcement. Do not secure such items in position by wiring or welding them to the reinforcement.
- H. Where practicable, provide for openings for pipes, inserts for pipe hangers and brackets, and setting of anchors during placing of concrete.
- I. Accurately set anchor bolts and maintain in position with templates while they are being embedded in concrete.
- J. Cleaning: Immediately before concrete is placed, thoroughly clean dirt, grease, grout, mortar, loose scale, rust and other foreign substances from surfaces of metalwork to be in contact with concrete.

3.03 HANDLING, TRANSPORTING AND PLACING CONCRETE

- A. Conform to applicable requirements of Chapter 8 of ACI 301 and this Section. Use no aluminum materials in conveying concrete.
- B. Rejected Work: Remove concrete found to be defective or non-conforming in materials or workmanship. Replace rejected concrete with concrete meeting requirements of Contract Documents, at no additional cost to the Owner.

- C. Unauthorized Placement: Place no concrete except in the presence of the Resident Project Representative. Notify the Resident Project Representative in writing at least 24 hours before placement of concrete.
- D. Placement in Wall Forms:
1. Do not drop concrete through reinforcing steel.
 2. Do not place concrete in any form so as to leave an accumulation of mortar on form surfaces above the concrete.
 3. Pump concrete or use hoppers and, if necessary, vertical ducts of canvas, rubber or metal (other than aluminum) for placing concrete in forms so it reaches the place of final deposit without separation. Free fall of concrete shall not exceed 4 feet below the ends of pump hoses, ducts, chutes or buggies. Uniformly distribute concrete during depositing.
 4. Do not displace concrete in forms more than 6 feet in horizontal direction from place where it was originally deposited.
 5. Deposit in uniform horizontal layers not deeper than 2 feet; take care to avoid inclined layers or inclined construction joints except where required for sloping members.
 6. Place each layer while the previous layer is still soft. Rate of placement shall not exceed 5 feet of vertical rise per hour.
 7. Provide sufficient illumination in form interior so concrete at places of deposit is visible from the deck or runway.
- E. Conveyors and Chutes: Design and arrange ends of chutes, hopper gates and other points of concrete discharge in the conveying, hoisting and placing system so concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyors, if used, shall be of a type acceptable to the Resident Project Representative. Do not use chutes longer than 50 feet. Slope chutes so concrete of specified consistency will readily flow. If a conveyor is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyors and chutes shall be covered.
- F. Placement of Slabs: In hot or windy weather, conducive to plastic shrinkage cracks, apply evaporation retardant to slab after screeding in accordance with manufacturer's instructions and recommendations. Do not use evaporation retardant to increase water content of the surface cement paste. Place concrete for sloping slabs uniformly from the

bottom of the slab to the top, for the full width of the placement. As work progresses, vibrate and carefully work concrete around slab reinforcement. Scream the slab surface in an up-slope direction.

- G. Concrete Temperature: When placed, not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick, nor less than 50 degrees for all other sections. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When concrete temperature is 85 degrees F or above, do not exceed 60 minutes between introduction of cement to the aggregates and discharge. When the weather is such that the concrete temperature would exceed 90 degrees F, employ effective means, such as pre-cooling of aggregates and mixing water, using ice or placing at night, as necessary to maintain concrete temperature, as placed, below 90 degrees F.
- H. Cold Weather Placement: Conform to ACI 306.1 - Standard Specification for Cold Weather Concreting, and the following:
 - 1. Remove snow, ice and frost from surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. Warm reinforcement and embedded items to above 32 degrees F prior to concrete placement.
 - 2. Maintain concrete temperature above 50 degrees F for at least 3 days after placement.

3.04 PUMPING OF CONCRETE

- A. If pumped concrete does not produce satisfactory results, in the judgment of the Resident Project Representative, discontinue pumping operations and proceed with the placing of concrete using conventional methods.
- B. Pumping Equipment: Use a 2-cylinder pump designed to operate with only one cylinder if one is not functioning, or have a standby pump on site during pumping.
- C. The minimum hose (conduit) diameter: Comply with ACI 304.2R.
- D. Replace pumping equipment and hoses (conduits) that do not function properly.
- E. Do not use aluminum conduits for conveying concrete.
- F. Field Control: Take samples for slump, air content and test cylinders at the placement (discharge) end of the line.

3.05 CONCRETE PLACEMENT SEQUENCE

- A. Place concrete in a sequence acceptable to the Engineer. To minimize effects of shrinkage, place concrete in units bounded by construction joints shown. Place alternate units so each unit placed has cured at least 7 days for hydraulic structures, or 3 days for other structures, before contiguous unit or units are placed, except do not place corner sections of vertical walls until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for other structures.
- B. Level the concrete surface whenever a run of concrete is stopped. To ensure straight and level joints on the exposed surface of walls, tack a wood strip at least 3/4-inch thick to the forms on these surfaces. Carry concrete about 1/2 inch above the underside of the strip. About one hour after concrete is placed, remove the strip, level irregularities in the edge formed by the strip with a trowel and remove laitance.

3.06 TAMPING AND VIBRATING

- A. Thoroughly settle and compact concrete throughout the entire depth of the layer being consolidated, into a dense, homogeneous mass; fill corners and angles, thoroughly embed reinforcement, eliminate rock pockets and bring only a slight excess of water to the exposed surface of concrete during placement. Use ACI 309R Group 3 immersion-type high-speed power vibrators (8,000 to 12,000 rpm) in sufficient number and with sufficient (at least one) standby units. Use Group 2 vibrators only when accepted by the Resident Project Representative for specific locations.
- B. Use care in placing concrete around waterstops. Carefully work concrete by rodding and vibrating to make sure air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, work concrete under waterstops by hand, making sure air and rock pockets have been eliminated. Give concrete surrounding the waterstops additional vibration beyond that used for adjacent concrete placement to assure complete embedment of waterstops in concrete.
- C. Concrete in Walls: Internally vibrate, ram, stir, or work with suitable appliances, tamping bars, shovels or forked tools until concrete completely fills forms or excavations and closes snugly against all surfaces. Do not place subsequent layers of concrete until previously-placed layers have been so worked. Provide vibrators in sufficient numbers, with standby units as required to accomplish the results specified within 15 minutes after concrete of specified consistency is placed in the forms. Keep vibrating heads from contact with form surfaces. Take care not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 PLACING MASS CONCRETE

- A. Observe the following additional restrictions when placing mass concrete.
 - 1. Use specified superplasticizer.
 - 2. Maximum temperature of concrete when deposited: 70 degrees F.
 - 3. Place in lifts approximately 18 inches thick. Extend vibrator heads into previously-placed layer.

3.08 REPAIRING SURFACE DEFECTS AND FINISHING

- A. Conform to the section entitled, "Concrete Finishing."

3.09 CURING

- A. Conform to the section entitled, "Concrete Curing."

3.10 PROTECTION

- A. Protect concrete against damage until final acceptance by the Owner.
- B. Protect fresh concrete from damage due to rain, hail, sleet or snow. Provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.
- C. Do not backfill around concrete structures or subject them to design loadings until all components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Engineer.

END OF SECTION

SECTION 03350
CONCRETE FINISHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Repairing surface defects.
- B. Finishing concrete surfaces including both formed and unformed surfaces.
- C. Sealing concrete surfaces.
- D. Installation of concrete fill and installation of concrete topping in bottoms of clarifiers and thickeners.

1.02 REFERENCES

- A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- B. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- C. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- D. ASTM D4587 – Standard Practice for Fluorescent UV-Condensation of Paint and Related Coatings
- E. ASTM E1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the F Number System.

1.03 SUBMITTALS

- A. Conform to the section entitled, "SUBMITTALS."
- B. Submit manufacturer's technical literature on the following products proposed for use. Include manufacturer's installation and application instructions and, where specified, manufacturer's certification of conformance to requirements and suitability for use in the applications indicated.

- 1. Floor hardener.

2. Sealer.
3. Epoxy floor topping.
4. Epoxy penetrating sealer.
5. Latex bonding agent.
6. Epoxy adhesive.
7. Abrasive aggregate.
8. Evaporation retardant.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sealer/Dustproofer (VOC Compliant): Water-based acrylic sealer; non-yellowing under ultraviolet light after 200-hour test in accordance with ASTM D4587. Conform to local, state and federal solvent emission requirements.
- B. Epoxy Floor Topping: Two-component epoxy resin meeting ASTM C881 Type III, resistant to wear, staining and chemical attack, blended with granite, sand, trap rock or quartz aggregate, trowel-applied over concrete floor. Topping thickness, 1/8 inch; color, gray.
- C. Abrasive Aggregate for Nonslip Finish: Fused aluminum oxide grit, or crushed emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Material shall be factory graded, packaged, rustproof and non-glazing, and unaffected by freezing, moisture and cleaning materials.
- D. Epoxy Penetrating Sealer: Low-viscosity, two-component epoxy system designed to give maximum penetration into concrete surfaces. Sealer shall completely seal concrete surfaces from penetration of water, oil and chemicals; prevent dusting and deterioration of concrete surfaces caused by heavy traffic; and be capable of adhering to floor surfaces subject to hydrostatic pressure from below. Color, transparent amber or gray; surface, nonslip.
- E. Latex Bonding Agent: Non re-dispersible latex base liquid conforming to ASTM C1059. When used in water and wastewater treatment structures, bonding agent shall be suitable for use under continuously submerged conditions.

Conformance and suitability certification by manufacturer is required.

- F. Bonding Grout: Prepare bonding grout by mixing approximately one part cement to one part fine sand meeting ASTM C 144 but with 100 percent passing No. 30 mesh sieve. Mix with water to consistency of thick cream. At Contractor's option, a commercially-prepared bonding agent used in accordance with manufacturer's recommendations and instructions may be used. When used in water and wastewater treatment structures, bonding agent shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required. Submit manufacturer's technical information on proposed bonding agent.
- G. Patching Mortar:
1. Make patching mortar of same materials and of approximately same proportions as concrete, except omit coarse aggregate. Substitute white Portland cement for part of gray Portland cement on exposed concrete in order to match color of surrounding concrete. Determine color by making trial patch. Use minimum amount of mixing water required for handling and placing. Mix patching mortar in advance and allow to stand. Mix frequently with trowel until it has reached stiffest consistency that will permit placing. Do not add water.
 2. Proprietary compounds for adhesion or specially formulated cementitious repair mortars may be used in lieu of or in addition to foregoing patching materials provided that properties of bond and compressive strength meet or exceed the foregoing and color of surrounding concrete can be matched where required. Use such compounds according to manufacturer's recommendations. When used in water and wastewater treatment structures, material shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required.
- H. Epoxy Adhesive: Two-component, 100 percent solids, 100 percent reactive compound developing 100 percent of strength of concrete, suitable for use on dry or damp surfaces. Epoxy used to inject cracks and as a binder in epoxy mortar shall meet ASTM C 881, Type VI. Epoxy used as a bonding agent for fresh concrete shall meet ASTM C 881, Type V.
- I. Non-shrink Grout: See the section entitled, "STRUCTURAL GROUT."
- J. Spray-Applied Coating: Acceptable products are Thoro System Products "Thorseal Plaster Mix" or equal. Color: Gray.
- K. Concrete Topping: Class H concrete with 3/8-inch maximum coarse aggregate size, as specified in the section entitled, "STRUCTURAL CONCRETE."

- L. Concrete Fill: Class H concrete with 3/8-inch maximum coarse aggregate size, (Class C where fill thickness exceeds 3 inches throughout a placement), as specified in the section entitled, "STRUCTURAL CONCRETE."
- M. Evaporation Retardant: Confilm, manufactured by Master Builders; Eucobar, manufactured by Euclid Chemical Company; or equal.

PART 3 - EXECUTION

3.01 AGGREGATE CONCEALMENT

- A. Unless indicated otherwise on Drawings or approved by Engineer, all surfaces to be finished shall be free of exposed aggregate.

3.02 REPAIRING SURFACE DEFECTS

- A. Defective Areas: Repair immediately after removal of forms. Remove honeycombed and other defective concrete down to sound concrete but in no case to a depth less than one inch. Make edges of cuts perpendicular to concrete surface. Thoroughly work bonding grout into the surface with a brush as that the entire surface is covered. Alternatively, a proprietary bonding agent may be used. Use bonding agent in accordance with manufacturer's instructions. While bonding coat is still tacky, apply premixed patching mortar. Thoroughly consolidate mortar into place and strike off to leave patch slightly higher than surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finishing. Keep patched area damp for 7 days. Alternatively, a proprietary cementitious repair mortar may be used and placed in accordance with manufacturer's instructions. Do not use metal tools in finishing patches in formed walls which will be exposed.
- B. Tie Holes: Patch holes immediately after removal of forms. After cleaning and roughening with a wire brush on a rotary drill, thoroughly dampen tie hole and fill solid with patching mortar. Taper tie holes shall have the plug, specified in the section entitled, "CONCRETE STRUCTURES," driven into the hole to the center of the wall before grouting. Completely fill taper tie holes with patching mortar except that non-shrink grout shall be used for all walls in contact with soil or liquid. On wall faces exposed to view, fill the outer 2 inches of the taper tie hole with patching mortar blended to match adjacent concrete.

- C. Cracks: Repair cracks in excess of 0.01 inch by pressure injection of moisture-insensitive epoxy-resin system. Submit proposed material and method of repair for approval prior to making repairs.
- D. Structural Repair: When required, make structural repairs after prior approval of Engineer as to method and procedure, using specified epoxy adhesive or approved epoxy mortar.

3.03 FINISHING OF FORMED SURFACES

- A. Unfinished Surfaces: Finish is not required on surfaces concealed from view in completed structure by earth, ceilings or similar cover, unless indicated otherwise on Drawings.
- B. Rough Form Finish:
 - 1. No form facing material is required on rough form finish surfaces.
 - 2. Patch tie holes and defects. Chip off fins exceeding 1/4 inch in height.
 - 3. Rough form finish may be used on concrete surfaces which will be concealed from view by earth in completed structure, except concealed surfaces required to have smooth form finish, as shown on Drawings.
- C. Smooth Form Finish:
 - 1. Form facing shall produce smooth, hard, uniform texture on concrete. Use plywood or fiberboard linings or forms in as large sheets as practicable, and with smooth, even edges and close joints.
 - 2. Patch tie holes and defects. Rub fins and joint marks with wooden blocks to leave smooth, unmarred finished surface.
 - 3. Provide smooth form finish on the wet face of formed surfaces of water-holding structures, and of other formed surfaces not concealed from view by earth in completed structure, except where otherwise indicated on Drawings. Walls that will be exposed after future construction, at locations indicated on Drawings, shall have smooth form finish. Smooth form finish on exterior face of exterior walls shall extend 2 feet below final top of ground elevation. Exterior face of all perimeter grade beams shall have smooth form finish for full depth of grade beam.
- D. Rubbed Finish:

1. Use plywood or fiberboard linings or forms in as large sheets as practicable, and with smooth, even edges and close joints.
 2. Remove forms as soon as practicable, repair defects, wet surfaces, and rub with No. 16 carborundum stone or similar abrasive. Continue rubbing sufficiently to bring surface paste, remove form marks and fins, and produce smooth, dense surface of uniform color and texture. Do not use cement paste other than that drawn from concrete itself. Spread paste uniformly over surface with brush. Allow paste to reset, then wash surface with clean water.
 3. Use rubbed finish at locations indicated on Drawings, except where rubbed finish is indicated for a wall which will be containing a liquid, use spray-applied coating.
- E. Spray-applied Coating: At Contractor's option, in lieu of rubbed finish, spray-applied coating may be applied after defects have been repaired and fins removed. Remove form oil, curing compound and other foreign matter that would prevent bonding of coating. Apply coating in uniform texture and color in accordance with coating manufacturer's instructions.
- F. Related Unformed Surfaces: Tops of piers, walls, bent caps, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to texture reasonably consistent with that of formed surfaces. Continue final treatment on formed surfaces uniformly across unformed surfaces.

3.04 HOT WEATHER FINISHING

- A. When hot weather conditions exist, as defined by the section entitled, "STRUCTURAL CONCRETE" and as judged by the Engineer, apply evaporation retardant to the surfaces of slabs, topping and concrete fill placements immediately after each step in the finishing process has been completed.

3.05 FINISHING SLABS AND SIMILAR FLAT SURFACES TO CLASS A, B, AND C TOLERANCES

- A. Apply Class A, B, and C finishes at locations indicated on Drawings.

- B. Shaping to Contour: Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to proper contour. See the section entitled, "CONCRETE STRUCTURES" for edge forms and screeds.
- C. Consolidation and Leveling: Concrete to be consolidated shall be as stiff as practicable. Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Consolidate and level slabs and floors with vibrating bridge screeds, roller pipe screeds or other approved means. After consolidation and leveling, do not permit manipulation of surfaces prior to finishing operations.
- D. Tolerances for Finished Surfaces: Check tolerances by placing straightedge of specified length anywhere on slab. Gap between slab and straightedge shall not exceed tolerance listed for specified class.

Class	Straight Edge Length in Feet	Tolerance in Inches
A	10	1/8
B	10	1/4
C	2	1/4

- E. Raked Finish: After concrete has been placed, struck off, consolidated and leveled to Class C tolerance, roughen surface before final set. Roughen with stiff brushes or rakes to depth of approximately 1/4 inch. Notify Engineer prior to placing concrete requiring initial raked surface finish so that acceptable raked finish standard may be established for project. Protect raked, base-slab finish from contamination until time of topping. Provide raked finish for following:
 - 1. Surfaces to receive bonded concrete topping or fill.
 - 2. Steep ramps, as noted on Drawings.
 - 3. Additional locations as noted on Drawings.
- F. Float Finish:
 - 1. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when mix has stiffened sufficiently to permit proper operation of power-driven float. Consolidate surface with power-driven floats. Use hand floating with wood or

cork-faced floats in locations inaccessible to power-driven machine and on small, isolated slabs.

2. After initial floating, re-check tolerance of surface with 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots to Class B tolerance. Immediately re-float slab to a uniform, smooth, granular texture.
3. Provide float finish at locations not otherwise specified and not otherwise indicated on Drawings.

G. Trowel Finish:

1. Apply float finish as previously specified. After power floating, use power trowel to produce smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional troweling by hand after surface has hardened sufficiently. Do final troweling when ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling operations.
2. Produce finished surface free of trowel marks, uniform in texture and appearance and conforming to Class A tolerance. On surfaces intended to support floor coverings, remove defects which might show through covering by grinding.
3. Provide trowel finish for floors which will receive floor covering and additional locations indicated on Drawings.

H. Broom or Belt Finish:

1. Apply float finish as previously specified. Immediately after completing floated finish, draw broom or burlap belt across surface to give coarse transverse scored texture.
2. Provide broom or belt finish at locations indicated on Drawings.

3.06 FINISHING SLABS AND SIMILAR FLAT SURFACES TO "F-NUMBER SYSTEM" FINISH

- A. Shaping to Contour: Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to proper contour. Edge forms and screeds: Conform to the section entitled, "CONCRETE STRUCTURES."
- B. Consolidation and Leveling: Concrete to be consolidated shall be as dry as practicable. Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Consolidate and level slabs and

floors with vibrating bridge screeds, roller pipe screeds or other approved means. After consolidation and leveling, do not manipulate surfaces prior to finishing operations.

C. Tolerances for Finished Surfaces: Independent testing laboratory will check floor flatness and levelness in accordance with paragraph 3.12, Field Quality Control.

D. Float Finish:

1. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when mix has stiffened sufficiently to permit proper operation of power-driven float. Consolidate surface with power-driven floats. Use hand floating with wood or cork-faced floats in locations inaccessible to power-driven machine and on small, isolated slabs.
2. Check tolerance of surface after initial floating with a 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots. Immediately refloat slab to uniform, smooth, granular texture to FF20/FL17 tolerance, unless shown otherwise on Drawings.
3. Provide "F-Number System" float finish at locations indicated on Drawings.

E. Trowel Finish:

1. Apply float finish as previously specified. After power floating, use power trowel to produce smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional trowelings by hand after surface has hardened sufficiently. Do final troweling when ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling operations.
2. Produce finished surface free of trowel marks, uniform in texture and appearance and conforming to an FF25/FL20 tolerance for slabs on grade and FF25/FL17 for elevated slabs, unless shown otherwise on Drawings. On surfaces intended to support floor coverings, remove defects, which might show through covering, by grinding.

3.07 BONDED CONCRETE TOPPING AND FILL

A. Surface Preparation:

1. Protect raked, base-slab finish from contamination until time of topping. Mechanically remove oil, grease, asphalt, paint, clay stains or other contaminants,

leaving clean surface.

2. Prior to placement of topping or fill, thoroughly dampen roughened slab surface and leave free of standing water. Immediately before topping or fill is placed, scrub coat of bonding grout into surface. Do not allow grout to set or dry before topping or fill is placed.

B. Concrete Fill:

1. Where concrete fill intersects a wall surface at an angle steeper than 45 degrees from vertical, provide a 1.5-inch deep keyway in the wall at the point of intersection; size keyway so that no portion of the concrete fill is less than 1.5 inches thick. Form keyway in new walls; create by saw cutting the top and bottom lines and chipping in existing walls.
2. Apply wood float finish to surfaces of concrete fill.
3. Provide concrete fill at locations shown on Drawings.

3.08 EPOXY PENETRATING SEALER

- A. Surfaces to receive epoxy penetrating sealer: Apply wood float finish. Clean surface and apply sealer in compliance with manufacturer's instructions.
- B. Rooms with concrete curbs or bases: Continue application of floor coating on curb or base to its juncture with masonry wall. Rooms with solid concrete walls or wainscots: Apply minimum 2-inch-high coverage of floor coating on vertical surface.
- C. Mask walls, doors, frames and similar surface to prevent floor coating contact.
- D. When coving floor coating up vertical concrete walls, curbs, bases or wainscots, use masking tape or other suitable material to keep a neat level edge at top of cove.
- E. Provide epoxy penetrating sealer at locations indicated on Drawings.

3.09 EPOXY FLOOR TOPPING

- A. Surfaces to receive epoxy floor topping: Apply wood float finish unless recommended otherwise by epoxy floor topping manufacturer. Clean surface and apply epoxy floor topping in compliance with manufacturer's recommendations and instructions. Thickness of topping: 1/8 inch.
- B. Rooms with concrete curbs or bases: Continue application of floor coating on curb or base to its juncture with masonry wall. Rooms with solid concrete walls or wainscots:

apply 2-inch-high coverage of floor coating on vertical surface.

- C. Mask walls, doors, frames and similar surfaces to prevent floor coating contact.
- D. When coving floor coating up vertical concrete walls, curbs, bases or wainscots, use masking tape or other suitable material to keep a neat level edge at top of cove.
- E. Finished surface shall be free of trowel marks and dimples.
- F. Provide epoxy floor topping at locations indicated on Drawings.

3.10 SEALER/DUSTPROOFER

- A. Where sealer or sealer/dustproofers is indicated on Drawings, just prior to completion of construction, apply coat of specified clear sealer/dustproofing compound to exposed interior concrete floors in accordance with manufacturer's instructions.

3.11 NONSLIP FINISH

- A. Apply float finish as specified. Apply two-thirds of required abrasive aggregate by method that ensures even coverage without segregation and re-float. Apply remainder of abrasive aggregate at right angles to first application, using heavier application of aggregate in areas not sufficiently covered by first application. Re-float after second application of aggregate and complete operations with troweled finish. Perform finishing operations in a manner that will allow the abrasive aggregate to be exposed and not covered with cement paste.
- B. Provide nonslip finish at locations indicated on Drawings.

3.12 FIELD QUALITY CONTROL

- A. Flatness and levelness of slabs and similar flat surfaces that are indicated on Drawings to receive "F-Number System" finish will be checked by independent testing laboratory employed by Owner in accordance with the section entitled, "TESTING LABORATORY SERVICES."
- B. Tolerances for "F-Number System" finished surfaces:
 - 1. Floor tolerance shall be determined in accordance with ASTM E1155.
 - 2. Floor flatness and levelness tolerances:

a. F_F defines maximum floor curvature allowed over 24 inches. Computed on the basis of successive 12-inch elevation differentials, F_F is commonly referred to as the “flatness F-Number.”

b. $F_F = \underline{\hspace{10em} 4.57 \hspace{10em}}$

Maximum difference in elevation, in decimal inches,
between successive 12-inch elevation differences.

c. F_L defines relative conformity of floor surface to horizontal plane as measured over 10-foot distance. F_L is commonly referred to as “levelness F-number.”

d. $F_L = \underline{\hspace{10em} 12.5 \hspace{10em}}$

Maximum difference in elevation, in inches,
between two points separated by 10 feet.

3. Achieve specified overall slab tolerance. Minimum local tolerance (1/2 bay, unless otherwise designated by Engineer): 2/3 of specified tolerance.
4. Tolerance for floated finish: FF20/FL17, unless otherwise shown on Drawings.
5. Tolerance for troweled finish: FF25/FL20 for slabs on grade, and FF25/FL17 for elevated slabs, unless otherwise shown on Drawings.

3.13 CURING

- A. Conform to requirements of the section entitled, “CONCRETE CURING.”

END OF SECTION

SECTION 03390
CONCRETE CURING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Curing of structural concrete.

1.02 REFERENCES

- A. ACI 308 - Standard Specification for Curing Concrete.
- B. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete.
- C. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- D. ASTM D4587 - Conducting Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.

1.03 DEFINITIONS

- A. Mass Concrete: Concrete sections 4 feet or more in least dimension.

1.04 SUBMITTALS

- A. Conform to the section entitled, "SUBMITTALS."
- B. Product Data: Submit description of proposed curing method for concrete. When use of membrane-forming compound is proposed, submit manufacturer's technical information including material specifications, installation instructions and recommendations, and evidence that compound is satisfactory for intended application. State locations where curing compound will be used.
- C. When membrane-forming compounds are to be used, submit certification by the manufacturer of compliance with specified requirements and compatibility with toppings, coatings, finishes, and adhesives to be applied.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Membrane-forming Curing Compound: Conform to ASTM C309, Type 1D, and following requirements.
 - 1. Minimum solids content: 30 percent.
 - 2. Compound shall not permanently discolor concrete. When used for liquid-containing structures, curing compound shall be white-pigmented.
 - 3. When used in areas that are to be coated, or that will receive topping or floor covering, material shall not reduce bond of coating, topping, or floor covering to concrete. Curing compound manufacturer's technical information shall state conditions under which compound will not prevent bond.
 - 4. Conform to local, state and federal solvent emission requirements.
- B. Clear Curing and Sealing Compound (VOC Compliant): Conform to ASTM C 309, Type 1, Class B, and the following requirements: 30 percent solids content minimum; non-yellowing under ultraviolet light after 500-hour test in accordance with ASTM D 4587. Sodium silicate compounds are not permitted. Conform to local, state and federal solvent emission requirements.
- C. Sheet Material for Curing Concrete: ASTM C171; waterproof paper, polyethylene film or white burlap-polyethylene sheeting.
- D. Curing Mats (for use in Curing Method 2): Heavy shag rugs or carpets, or cotton mats quilted at 4 inches on center; 12 ounce per square yard minimum weight when dry.
- E. Water for curing: Clean and potable.

PART 3 - EXECUTION

3.01 CURING PROCEDURES

- A. Comply with ACI 308 and the requirements specified herein. Protect freshly-deposited concrete from premature drying and excessively hot or cold temperatures. Maintain minimal moisture loss and relatively constant temperature during time necessary for hydration of cement and proper hardening of concrete.

- B. Unformed Surfaces: For concrete surfaces not in contact with forms, use one of the following procedures immediately after completion of placement and finishing.
1. Ponding or continuous sprinkling.
 2. Absorptive mat or fabric kept continuously wet.
 3. Sand or other covering kept continuously wet.
 4. Continuous steam bath (not exceeding 150 degrees F at surface of concrete).
 5. Vapor mist bath.
 6. Membrane-forming curing compound applied according to manufacturer's recommendations. After the curing compound has dried, wet slab surfaces and cover with waterproof paper, polyethylene film, or white burlap-polyethylene sheeting after the application of the curing compound. Tape sheet seams together and provide sufficient weights to keep the sheeting in place. Wet the slab surface again if the sheeting becomes dislodged, and replace the sheeting.
 7. Other moisture-retaining coverings as approved by Engineer.
- C. Restrictions on Use of Curing Compounds: Unless curing compound manufacturer certifies that curing compound will not prevent bond to cured surface, do not use curing compound on surfaces that will be rubbed or receive additional concrete, mortar, topping, terrazzo or other cementitious finishing materials, on slabs under resilient floors or built-up roofing, or on surfaces to be waterproofed, sealed, hardened or painted.
- D. Curing and Sealing Compounds: At locations indicated, cure exposed interior slabs and troweled slabs receiving mastic-applied adhesives with specified clear curing and sealing compound in accordance with manufacturer's recommendations. Do not store materials directly on curing membranes. Use plywood to protect curing membrane from damage. Immediately repair membranes damaged by foot traffic or other operations.
- E. Duration of Curing: Continue curing until cumulative number of days or fractions of days during which ambient temperature is above 50 degrees F has totaled 7. Continue curing of water-retaining structures for a total of 14 days. When high-early-strength concrete has been used, continue curing for total of 3 days. Prevent rapid drying at end of curing period.
- F. Formed Surfaces: During the curing period keep wet steel forms heated by sun and wood forms in contact with concrete. When forms are to be removed during curing period, employ curing materials or methods immediately.

Continue such curing for remainder of curing period.

G. Temperature:

1. Cold Weather. When mean daily temperature of atmosphere is less than 40 degrees F, maintain temperature of concrete between 50 and 70 degrees F for required curing period. When necessary, make arrangements for heating, covering, insulating or housing concrete work in advance of placement to maintain required temperature and moisture conditions. Prevent damage or injury due to concentration of heat. When combustion heaters are necessary in enclosed or protected area where concrete slabs are being placed, vent heaters.
2. Hot Weather. In advance of placement make arrangements for shading, fog spraying, sprinkling, ponding or installation of windbreaks or wet covering of light color. Take such protective measures as quickly as concrete hardening and finishing operations will allow.
3. Temperature Changes. Control so rate of change in temperature of concrete is as uniform as possible. Do not permit temperature change to exceed 5 degrees F in any one hour or 50 degrees F in any 24-hour period.

H. Protection from Mechanical Injury. During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods, and by rain or running water. Do not load self-supporting structures in a way that over stresses concrete.

3.02 CURING MASS CONCRETE

A. Observe the following additional restrictions when curing mass concrete.

1. Minimum curing period: 2 weeks.
2. When ambient air temperature falls below 32 degrees F, protect surface of concrete against freezing.
3. Do not use steam or other curing methods that will add heat to concrete.
4. Keep forms and exposed concrete continuously wet for at least the first 48 hours after placing, and whenever surrounding air temperature is above 90 degrees F during final curing period.

5. During 2-week curing period, provide necessary controls to prevent ambient air temperature immediately adjacent to concrete from falling more than 30 degrees F in 24 hours.

END OF SECTION

SECTION 03600
STRUCTURAL GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Non-shrink grout used wherever grout is shown in the Documents, unless another type is specifically referenced. Two classes of non-shrink grout (Class I and II) and areas of application are specified.

1.02 REFERENCES

- A. CRD C621 - Corps of Engineers Specification for Non-shrink Grout
- B. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
- C. ASTM C230 - Specifications for Flow Table for use in Tests of Hydraulic Cement
- D. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.03 SUBMITTALS

- A. Conform to the section entitled, "SUBMITTALS."
- B. Quality Control:
 - 1. The Contractor shall submit manufacturer's literature certifying compliance with the specified properties for Class I and II grouts.
 - 2. The Contractor shall submit manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.
- C. The Contractor shall submit manufacturer's written warranty as specified.

1.04 QUALITY ASSURANCE

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Resident Project Representative to ensure continued compliance with these Specifications. The specimens will be made by the Resident Project Representative or its representative.
2. Compression tests and fabrication of specimens for non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Resident Project Representative. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Grout already placed which fails to meet the requirements of these Specifications is subject to removal and replacement no additional cost to the owner.
4. The cost of laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Resident Project Representative in obtaining specimens for testing. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. The Contractor shall supply materials necessary for fabricating the test specimens.

B. Warranty:

1. Provide one-year warranty for work provided under this Section.
2. Manufacturer's warranty shall not contain a disclaimer limiting responsibility to only the purchase price of products or materials furnished.
3. Manufacturer shall warrant participation with Contractor in replacing or repairing grout found to be defective due to faulty materials, as determined by industry standard test methods.

PART 2 - PRODUCTS

2.01 APPLICATION

- A. The following is a listing of typical applications and the corresponding type of grout which is to be used. Unless indicated otherwise, grouts shall be provided as listed below whether or not called for on the Drawings.

Application:	Type of Grout
Structural member base plates	Non-shrink Class II
Storage tanks and other equipment	Non-shrink Class I
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-shrink Class II (Class I where placement time exceeds 15 minutes)
Under precast concrete elements	Non-shrink Class I
Toppings and concrete fill less than 3 inches thick	Concrete Topping per the section entitled, "STRUCTURAL CONCRETE"
Toppings and concrete fill greater than 3 inches thick	Concrete Fill per the section entitled, "STRUCTURAL CONCRETE"
Any application not listed above, where grout is called for on the Drawings	Non-shrink Class I, unless noted otherwise

2.02 PREPACKAGED GROUTS

- A. Basic Requirements for Cementitious Non-Shrink Grout
1. Provide prepackaged non-shrink grout that is inorganic, flowable, non-gas-liberating, non-metallic, and cement-based, requiring only the addition of water.

2. Deliver grout in original packaging with manufacturer's instructions printed on each container.
 3. Select the specific formulation for each class of non-shrink grout specified to conform to that recommended by the manufacturer for the particular application.
 4. Compressive strength at 28 days: 7000 psi minimum.
 5. Do not use a grout for which the non-shrink property is based on a chemically generated gas or gypsum expansion.
- B. Class I Non-Shrink Grout:
1. Supply Class I Grout conforming to these specifications and to CRD C621 and ASTM C1107 Grade C and B (as modified below) when tested using the amount of water needed to achieve the following properties:
 - a. Fluid consistency (20 to 30 seconds) per CRD C 611 at initial testing.
 - b. Fluid consistency (45 seconds) per CRD C 611 at 30 minutes after mixing.
 - c. At temperatures of 45, 73.4, and 95 degrees F.
 2. To satisfy non-shrink requirements, the length change from placement to time of final set shall not have a shrinkage greater than the amount of expansion measured after final set at 3 and 14 days. The expansion at 3 and 14 days shall not exceed the 28-day expansion.
 3. Fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.
 4. Demonstrate in tests that grout maintains contact with the baseplate to provide an minimum effective bearing area of 95 percent of the gross contact area after final set.
 5. The grout packaging shall list weight, maximum amount of mixing water to be used, maximum usable working time (pot life) at flowable consistency, and temperature restrictions for preparation and placement within which grout will meet specified requirements.

C. Class II Non-Shrink Grout:

1. Supply Class II Grout confirming to ASTM C1107 and the following requirements when tested using the amount of water needed to achieve the following properties:
 - a. Flowable consistency: 140 percent flow on ASTM C 230, five drops in 30 seconds.
 - b. Fluid working time: 15 minutes, minimum.
 - c. Flowable duration: 30 minutes, minimum.
2. When tested, the grout shall not bleed at maximum allowed water.

2.03 CURING MATERIALS

- A. Curing materials: As specified in the section entitled, "CONCRETE CURING" and as recommended by the manufacturer of prepackaged grouts.

2.04 CONSISTENCY

- A. Mix grouts to the consistency necessary to completely fill the space to be grouted. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that base concrete or masonry has attained design strength before grout is placed.
- B. When cementitious grouts are used on concrete surfaces, saturate the concrete surface with water for 24 hours prior to placement of cement-based grout. Upon completion of saturation period remove excess water prior to grouting.

3.02 GROUTING PROCEDURES

- A. Prepackaged Grouts: Perform mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts according to the written instructions of the manufacturer. Use prepackaged materials in the quantities and proportions as directed by the manufacturer unless there is certified test data verifying that the specified properties are attained by modified mix.

3.03 CONSOLIDATION

- A. Place grout in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

END OF SECTION

SECTION 04100
MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.

1.2 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Include design mix, indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- C. Reports: Submit reports on mortar indicating conformance of component mortar materials to requirements of ASTM C270.
- D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
- B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

- B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I, white & gray color for mock up; manufactured by Lehigh Cement.
- B. Mortar Sand: San Jacinto river sand.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Grout Course Aggregate: ASTM C404.
- E. Grout Fine Aggregate: San Jacinto river sand.
- F. Water: Clean and potable.

2.2 MORTAR MIXES

- A. Mortar For Load Bearing Walls and Partitions: ASTM C270, Type S using the Proportion specification.
- B. Mortar For Non-Load Bearing Walls and Partitions: ASTM C270, Type N using the Proportion specification.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-and-one-half hours at temperatures under 50 degrees F.

2.4 GROUT MIXES

- A. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 Course grout.

2.5 GROUT MIXING

- A. Mix grout in accordance with ASTM C94.
- B. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry sections.

END OF SECTION

SECTION 04210
BRICK UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A Brick masonry units.

1.2 SUBMITTALS

- A Submit product data and samples under provisions of Section 01300.
- B Submit product data for masonry units.
- C Submit cut brick sample panels in full range of colors and textures for preliminary selection.
- D Submit four samples of selected face brick units to illustrate color, texture and extremes of color range.
- E Submit manufacturer's certificate under provisions of Section 01400 that products meet or exceed specified requirements.

1.3 QUALIFICATIONS

- A Installer: Company specializing in performing the work of this Section with minimum three years documented experience.

1.4 MOCK-UP

- A Erect 12" x 12" samples of each brick on site to review and accept brick and mortar color. This may take more than one or two samples of each brick.
- B When accepted, mock-up will demonstrate minimum standard for the Work. Do not remove mock-up until all masonry work is completed.

1.5 PRE-INSTALLATION CONFERENCE

- A Convene one week prior to commencing work of this Section, under provisions of Section 01039.

1.6 DELIVERY, STORAGE, AND HANDLING

- A Deliver products to site under provisions of Section 016000.
- B Store and protect products under provisions of Section 016000.

1.7 ENVIRONMENTAL REQUIREMENTS

- A Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 BRICK UNITS

- A Face Brick: ANSI/ASTM C216, Type FBS, Grade SW; Manufacturer and color as shown on drawings.
- B Brick Masonry Units: Queen size 3 x 2-3/4 x 8 – (5 courses = 16”)

2.2 REINFORCEMENT AND ANCHORAGE

- A Manufacturers:
 - 1. Dur-O-Wal, Inc.
 - 2. Heckman Building Products, Inc.
 - 3. Hohmann & Barnard, Inc.
 - 4. Masonry Reinforcing Corp. of America.
- B Multiple Wythe Joint Reinforcement: Ladder type; with moisture drip; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with 9 gage cross ties.

- C Strap Anchors: U-shaped steel strap, 1/4 inch by 1 inch by 24 inches long between 3 inch I.D. bends, ASTM A526, G90.
- D Reinforcing Steel: ASTM A615, 40 ksi yield grade, deformed billet bars, unprotected finish.

2.3 FLASHINGS

- A. Refer to sections 07650 for flashing materials & information.

2.4 ACCESSORIES

- A Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self-expanding; 2 inch wide by maximum lengths; *Greyflex* manufactured by Emseal.
- B Cavity Drainage Mesh: High-density polyethylene open-mesh weave; manufactured by Mortar Net.
- C Weep Holes: High-density polyethylene open-mesh weave; manufactured by Mortar net.
- D Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A Verify that field conditions are acceptable and are ready to receive work.
- B Verify items provided by other Sections of work are properly sized and located.
- C Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A Direct and coordinate placement of metal anchors supplied to other Sections.
- B Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

- A Establish lines, levels, and coursing indicated. Protect from displacement.
- B Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C Lay brick units in running bond or as shown on Drawings. Course five (5) brick units and five (5) mortar joints to equal 16 inches. Form concave mortar joints.

3.4 PLACING AND BONDING

- A Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- C Remove excess mortar as Work progresses.
- D Interlock intersections and external corners.
- E Install cavity drainage mesh at bottom of cavity in layers as required.
- F Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.5 WEEPS

- A Install open weep holes in veneer at 24 inches on center horizontally above through-wall flashing.

3.6 CAVITY WALL

- A Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.
- B Build inner wythe ahead of outer wythe to receive cavity damproofing.

3.7 REINFORCEMENT AND ANCHORAGES - VENEER MASONRY

- A Secure wall ties to stud framed back-up and embed into masonry veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place at maximum 8 inches oc each way around perimeter of openings, within 12 inches of openings.

3.8 MASONRY FLASHINGS

- A Extend flashings under veneer, turn up minimum 8 inches and seal to concrete or sheathing over steel stud framed back-up.
- B Lap end joints minimum 6 inches and seal watertight.
- C Use flashing manufacturer's recommended adhesive and sealer.

3.9 LINTELS

- A Install loose steel lintels over openings.
- B Maintain minimum 4 inch bearing on each side of opening.

3.10 CONTROL AND EXPANSION JOINTS

- A Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- B Size control joint in accordance with Section 07900 for sealant performance.
- C Form expansion joint as detailed.

3.11 BUILT-IN WORK

- A As work progresses, build in metal door frames and items furnished by other Sections.
- B Build in items plumb and level.
- C Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
- D Do not build in organic materials subject to deterioration.

3.12 TOLERANCES

- A Maximum Variation From Alignment of Pilasters: 1/4 inch.
- B Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- D Maximum Variation From Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- F Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.
- G Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.

3.13 CUTTING AND FITTING

- A Obtain Architect approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

- A Clean work under provisions of Section 017700.
- B Remove excess mortar and mortar smears.
- C Replace defective mortar. Match adjacent work.
- D Clean soiled surfaces with cleaning solution.
- E Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK

- A Protect finished installation under provisions of Section 015000.
- B Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 04220
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A Concrete masonry units, fire rated and non-fire rated.

1.2 SUBMITTALS

- A Submit product data under provisions of Section 013300.
- B Submit manufacturer's certificate under provisions of Section 014000 that products meet or exceed specified requirements.

1.3 QUALIFICATIONS

- A Installer: Company specializing in performing the work of this Section with minimum three years documented experience.

1.4 PRE-INSTALLATION CONFERENCE

- A Convene one week prior to commencing work of this Section, under provisions of Section 013100.

1.5 DELIVERY, STORAGE, AND HANDLING

- A Deliver products to site under provisions of Section 01600.
- B Store and protect products under provisions of Section 01600.

1.6 ENVIRONMENTAL REQUIREMENTS

- A Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A Hollow Load Bearing Block Units: ASTM C90, Type I - Moisture Controlled; normal weight - compressive strength 3050 psi.
- B Masonry Units: Nominal modular face size of 16 x 8 inches. Provide special units for 90 degree corners, bond beams, and lintels.

2.2 REINFORCEMENT AND ANCHORAGE

- A Manufacturers:
 - 1. Dur-O-Wal, Inc.
 - 2. Heckman Building Products, Inc.
 - 3. Hohmann & Barnard, Inc.
 - 4. Masonry Reinforcing Corp. of America.
- B Single Wythe Joint Reinforcement: Ladder type; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 side rods with 9 gage cross ties.
- C Multiple Wythe Joint Reinforcement: Ladder type; with moisture drip; adjustable type, steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, cold drawn steel wire conforming to ASTM A82, 3/16 inch side rods with 9 gage cross ties.
- D Strap Anchors: U-shaped steel strap, 1/4 inch by 1 inch by 24 inches long between 3 inch I.D. bends, ASTM A526, G90.
- E Wall Ties for Structural Steel Backup: Triangular wire type; 3 inch, length to extend within 1/2 inch of exterior wythe face.
 - 1. Weld-on Strap: ASTM A570, Grade 40, finish ASTM A153, Class B-3; steel sheet, 12 gage by 3/4 inch by 9 inches long.
 - 2. Triangular Wire Tie: ASTM A82, cold-drawn steel, finish ASTM A153, Class B-3; 3/16 inch diameter.

- F Reinforcing Steel: ASTM A615, 40 ksi yield grade, deformed billet bars, unprotected finish.

2.3 ACCESSORIES

- A Preformed Control Joints: Rubber material. Provide with corner and tee accessories, heat fused joints, *Rapid Control Joint* manufactured by Dur-O-Wal, Inc.
- B Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self-expanding; 2 inch wide by maximum lengths; *Greyflex* manufactured by Emseal.
- C Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A Verify that field conditions are acceptable and are ready to receive work.
- B Verify items provided by other Sections of work are properly sized and located.
- C Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A Direct and coordinate placement of metal anchors supplied to other Sections.
- B Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

- A Establish lines, levels, and coursing indicated. Protect from displacement.
- B Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

- C Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.4 PLACING AND BONDING

- A Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B Lay hollow masonry units with face shell bedding on head and bed joints.
- C Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- D Remove excess mortar as Work progresses.
- E Interlock intersections and external corners.
- F Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H Isolate masonry partitions from vertical structural framing members with a control joint.
- I Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.5 REINFORCEMENT AND ANCHORAGES - SINGLE WYTHE MASONRY

- A Install horizontal joint reinforcement 16 inches oc.
- B Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C Place joint reinforcement continuous in first and second joint below top of walls.
- D Lap joint reinforcement ends minimum 6 inches.

3.6 LINTELS

- A Install loose steel lintels over window openings and door openings where scheduled.
- B Install reinforced unit masonry lintels over openings where steel lintels are not scheduled.
- C Openings Up To 42 Inches Wide: Place two, No. 4 reinforcing bars 1 inch from bottom web.
- D Openings From 42 Inches Up To 78 Inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.
- E Openings Over 78 Inches: Reinforce openings as detailed.
- F Use single piece reinforcing bars only.
- G Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- H Place and consolidate grout fill without displacing reinforcing.
- I Allow masonry lintels to attain specified strength before removing temporary supports.
- J Maintain minimum 8 inch bearing on each side of opening.

3.7 GROUTED COMPONENTS

- A Reinforce bond beam with 2, No. 4 bars, placed 1 inch from bottom web.
- B Lap splices minimum 24 bar diameters.
- C Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D Place and consolidate grout fill without displacing reinforcing.
- E At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.8 CONTROL AND EXPANSION JOINTS

- A Do not continue horizontal joint reinforcement through control and expansion joints.
- B Install control joints at 30' OC max. unless otherwise shown on the drawings.
- C Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D Size control joint in accordance with Section 07900 for sealant performance.
- E Form expansion joint as detailed.

3.9 BUILT-IN WORK

- A As work progresses, build in metal door and glazed frames and other items furnished by other Sections.
- B Build in items plumb and level.
- C Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 8 inches from framed openings.
- D Do not build in organic materials subject to deterioration.

3.10 TOLERANCES

- A Maximum Variation From Alignment of Pilasters: 1/4 inch.
- B Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- D Maximum Variation From Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- F Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.
- G Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.

3.11 CUTTING AND FITTING

- A Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of work to provide correct size, shape, and location.
- B Obtain Architect approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

- A Clean work under provisions of Section 01700.
- B Remove excess mortar and mortar smears.
- C Replace defective mortar. Match adjacent work.
- D Clean soiled surfaces with cleaning solution.
- E Use non-metallic tools in cleaning operations.

3.13 PROTECTION OF FINISHED WORK

- A Protect finished installation under provisions of Section 01500.
- B Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bolts, anchors, nuts, sleeves, concrete anchors, scheduled items, and other miscellaneous ferrous metal and sheet metal items not specifically included under other sections of these specifications.

1.02 SUBMITTALS

- A. Shop Drawings: Indicate materials, profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, finish and accessories. Include erection drawings showing locations, elevations, clearances, and details where applicable.
- B. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Submit manufacturer's technical literature and test reports showing certified capacities for concrete anchors.

1.03 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Texas.
- B. Welders' Certificates: Submit under provisions of Section entitled, "SUBMITTALS," certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Construction Plans.

PART 2 PRODUCTS

2.01 MATERIALS

A. Shop-primed Materials:

1. Steel Shapes, Bars and Plates: ASTM A36.
2. Structural Tube: Hot formed square or rectangular tubing, ASTM A501.
3. Cold-rolled Sheets: ASTM A366.
4. Cold-finished Bars: ASTM A108.
5. Pipe: ASTM A53, Schedule 40 if not shown otherwise.

B. Uncoated Ferrous Materials:

1. Stainless Steel: Austenitic Type 302 or 304, No. 4 belt polished, 50-180 grit finish, stainless steel conforming to ASTM A276, A269, A312, A632, as applicable.
2. Cast Iron: ASTM A48, Class 30B.
3. Stainless Steel Bolts and Nuts: Bolts per ASTM F593, Type 316; nuts per ASTM F594, Type 316; UNC coarse threads.
4. Concrete Anchors: Concrete anchors are inserted into holes drilled in hardened concrete and shall be one of the following types:
 - a. Adhesive Anchors: Concrete anchors which are submerged, in splash zones, in enclosed spaces over liquids, or anchoring vibrating equipment shall be epoxy adhesive anchors. Adhesive anchors may be used at all locations where concrete anchors are required. Epoxy systems shall be Sika/FI System with Sikadur Injection Gel Epoxy, Master Builders Concrecive Epoxy Cartridge Dispensing System and Concrecive Paste LPL, or equal. Threaded rods shall be ASTM F593, Type 316 studs. Where adhesive anchors, or connected metal, are exposed to direct sunlight, the anchors shall be certified to maintain at least 90 percent of their rated strength (tested at 73 degrees F) when tested at 160 degrees F.

- b. Expansion Anchors: Where concrete anchors are indicated and adhesive anchors are not required, wedge type anchors made with ASTM A276, Type 316 Stainless Steel shall be used. Anchors shall be KWIK Bolt III By Hilti, Inc. or approved equal.

C. Galvanized Materials:

- 1. Non-structural Pipe: ASTM A120.
- 2. Iron and Steel Hardware: ASTM A153.
- 3. Steel Shapes, Plates, Bars, and Strips: ASTM A123.
- 4. Steel Sheets: ASTM A446.
- 5. Assembled Steel Products: ASTM A386.
- 6. Delivery of Hot-dipped items: ASTM A525.

D. Aluminum Materials:

- 1. Standard Structural Shapes: ASTM B308.
- 2. Structural Pipe and Tube: ASTM B429.
- 3. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
- 4. Plate and Sheet: ASTM B209. Use alloy 3003-H16 for mill finish and alloy 5005-H16 for anodized finish.

2.02 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related

components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FINISHES

A. Steel Shop Primer:

1. Prepare surfaces to be primed in accordance with SSPC SP-2 and SP-1. Remove mill scale, loose rust, and other foreign materials.
2. Do not prime surfaces in direct contact with concrete or where field welding is required.
3. Acceptable Primers: Comply with F.S. TT-P-86, Type I or II, TT-P-636C, or SSPC – Paint 4-64T. Proprietary primers of equal performance may be used.
4. Application: Apply with spray only for Workmanship Classes 1 and 2. Apply primer free of runs and other irregularities that may require modification to achieve the specified finish appearance.

B. Galvanization: Galvanize, after completion of welded fabrication, in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating.

2.04 WORKMANSHIP CLASSES (Steel)

A. CLASS 1:

1. Exposed Surfaces: Sandblast surfaces smooth with pits, mill marks, nicks and scratches filled or ground off. Defects shall not show when painted.
2. Welds: Conceal welds where possible. Where exposed, grind welds to small radius with uniform sized cove. When painted, welds shall be undetectable.
3. Bolts: Use only flat head countersunk bolts in exposed locations.
4. Straightness: Distortions visible to the eye will be rejected.
5. Joints: Fit joints to hairline finish.

B. CLASS 2:

1. Exposed Surfaces: Moderate irregularities not visible at 30 feet may remain. Mill marks may remain.
2. Welds: Grind welds to small radius with uniform sized cove.
3. Bolts: Use only flat or oval head, countersunk bolts where exposed to view.
4. Straightness: Minor distortions will be permitted.
5. Joints: Provide maximum gap of 1/16 inch.

C. CLASS 3:

1. Exposed Surfaces: No improvement from mill finish required except preparation of galvanizing or priming.
2. Welds: Grinding not required.
3. Bolts: Exposed bolts permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.
- C. All stainless steel threads to be coated with an anti-seizing compound prior to installing the nuts.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects and as recommended by product manufacturer. Attach members firmly to abutting materials, parallel to adjoining construction.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
- F. Fill and sand screw heads and joints larger than a hairline in Class 1 workmanship items.
- G. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

3.04 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.05 SCHEDULE

- A. General - The Schedule is a list of principal items only. Refer to Construction Plans details for items not specifically scheduled. Items not listed require the following workmanship classes and finishes.
 - 1. Exposed items in finished areas: Class 1.
 - 2. Exposed items in utility areas: Class 2.
 - 3. Concealed items: Class 3.
 - 4. Items not subject to contact with moisture: Primed finish.
 - 5. Items subject to contact with moisture: Galvanized finish.
- B. List of Typical Steel Items (Workmanship and Finish)

1. CLASS 1 Workmanship: (Shop Primer finish) Interior wall ladders to roof hatches.
 2. CLASS 2 Workmanship: (Shop Primer finish) Miscellaneous interior exposed angles.
 3. CLASS 2 Workmanship: (Galvanized finish)
 - a. Miscellaneous exterior exposed angles.
 - b. Exterior loose lintels.
 - c. Exterior wall ladders to roof.
 4. CLASS 3 Workmanship: (Shop Primer finish) Miscellaneous interior concealed angles.
 5. CLASS 3 Workmanship: (Galvanized finish) Miscellaneous exterior concealed angles.
- C. List of Typical Aluminum Items
1. Anodized Items: Closure panels and plates, exposed to view.

END OF SECTION

SECTION 05510

METAL STAIRS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A Steel stair frame of structural sections, with open risers.
- B Metal grate treads.
- C Integral guardrails and handrailings.

1.2 DESIGN REQUIREMENTS

- A Fabricate stair assembly to support a uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/240 of span.
- B Railing assembly, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set.
- C Follow IBC 2009 if the requirements are greater than listed above.

1.3 SUBMITTALS

- A Section 01300 - Submittals: Procedures for submittals.
- B Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories signed and sealed by Professional Structural Engineer licensed in the State of Texas.
- C Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

- A Perform Work in accordance with ASTM E985 - Permanent Metal Railing Systems and Rails for Buildings.

- B Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Texas.
- C Welders' Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.1 MATERIALS

- A Steel Sections: ASTM A36.
- B Steel Tubing: ASTM A500, Grade B or ASTM A501.
- C Pipe: ASTM A53, Grade B Schedule 40.
- D Sheet Steel: ASTM A446, Grade B Structural Quality.
- E Tread and Landing Concrete Reinforcement: Bar type as detailed, unfinished.
- F Bolts, Nuts, and Washers: ASTM A325.
- G Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- H Welding Materials: AWS D1.1; type required for materials being welded.
- I Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.2 FABRICATION - GENERAL

- A Fit and shop assemble components in largest practical sections, for delivery to site.
- B Fabricate components with joints tightly fitted and secured.
- C Continuously seal joined pieces by continuous welds.
- D Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

- E Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G Accurately form components required for anchorage of stairs, landings, and railings to each other and to building structure.

2.3 FABRICATION - PAN STAIRS AND LANDINGS

- A Fabricate stairs and landings with metal grates
- B Form treads and risers with minimum 12 gage sheet steel stock.
- C Secure treads to stringers with clip angles; welded in place.
- D Form stringers with rolled steel channels, 12 inches deep.
- E Reinforce underside of landings with angles or metal T's to attain design load requirements.
- F Form guardrails with minimum 1-1/2 inch diameter steel sections, welded to stringers.
- G Prime paint components.

2.4 FINISHES

- A Prepare surfaces to be primed in accordance with SSPC SP 2.
- B Do not prime surfaces in direct contact with concrete or where field welding is required.
- C Prime paint items with two coats.

PART 3 EXECUTION

3.1 EXAMINATION

- A Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A Clean and strip primed steel items to bare metal where site welding is required.
- B Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.3 INSTALLATION

- A Install components plumb and level, accurately fitted, free from distortion or defects.
- B Provide anchors required for connecting stairs to structure.
- C Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.
- E Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- F Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- G Obtain approval prior to site cutting or creating adjustments not scheduled.
- H After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 ERECTION TOLERANCES

- A Maximum Variation From Plumb: 1/4 inch per storey, non-cumulative.
- B Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05512
STRUCTURAL STEEL

PART 1 GENERAL

1.01 SCOPE

- A. This section in general covers the furnishing, fabrication and erection of steel for structural use, anchoring and metal items not specifically included under other specification sections.

1.02 SUBMITTALS

- A. Submit under provisions of Section entitled "SUBMITTALS".
- B. Shop Drawings: Indicate profiles, sizes, connections, attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
- D. Submit manufacturer's technical literature and test reports showing certified capacities for concrete anchors.

1.03 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Texas.
- B. Welder's Certificates: Submit under provisions of Section entitled "SUBMITTALS", certifying welders employed on the Work and verifying AWS qualifications within the previous 12-months.

1.04 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Construction Plans.

1.05 REFERENCES

- A. AISC Steel Construction Manual
- B. ASTM A36- Standard Specification for Carbon Structural Steel

- C. ASTM A123- Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- D. ASTM A307- Standard Specification for Carbon Steel Bolts and Steel, 60000 PSI Tensile Strength
- E. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength
- F. AWS A5.1- Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
- G. AWS D1.1- Structural Welding Code Steel.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General
 - 1. All structural steel shapes, plates, pipe support framing, bearing plates, and completely embedded steel items shall conform to ASTM Standard A36 unless otherwise shown on the plans.
 - 2. Structural steel for curb angles, sheet metal, embedded steel (not completely embedded), stairs and miscellaneous items shall conform to ASTM Standard A36 and shall be hot-dip galvanized after fabrication.
- B. Standard Bolts and Nuts
 - 1. Unless otherwise specified, noted on the drawings, or required, bolts and nuts shall conform to the requirements of ASTM Standard A325, latest edition, Grade A, with square head, hex nuts, and standard washers.
- C. Anchor Bolts
 - 1. Anchor bolts shall be galvanized and fabricated from new, ASTM A307 steel, round bar stock, complete with American Standard threads, hex nuts, and washer unless otherwise noted.
- D. Pipe Supports
 - 1. The pipe supports shall be fabricated from steel conforming to ASTM Standard A36, latest edition.

2.02 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface.

2.03 FINISHES

- A. Do not prime surfaces in direct contact with concrete or where field welding is required.
- B. Galvanize, after completion of welded fabrication, in accordance with ASTM A123. Provide minimum 1.25 oz/sq. ft. galvanized coating.

2.04 PAINT MATERIALS

- A. Provide the manufacturer's best-quality paint material of the type specified or approved by Engineer. Paint material containers not displaying manufacturer's product identification will not be acceptable.
- B. Painting Specifications:
 - 1. 1st Coat: Devco Devshield Rust Penetrating Metal Primer 4130-6130
 - 2. 2nd Coat: Devco Devflex Exterior Waterborne Acrylic Semi-gloss 4206 (color as directed)

PART 3 EXECUTION

3.01 FABRICATION AND ERECTION

- A. General
 - 1. All welding to be performed in the field shall be by welders having current weld certifications in accordance with AWS for that type/class of weld.
 - 2. All shop fabrication, field fabrication and erection shall be in accordance with the latest edition of the AISC Manual and Specifications for fabrication and erection of buildings. All fabrication shall be welded construction, unless otherwise shown or approved by the Engineer.
 - 3. Verify that field conditions are acceptable and are ready to receive work.

B. Welding

1. Welding electrodes and welding procedures shall conform to the latest requirements of the AWS A5.1 and D1.1.
2. Clean and strip steel items bare metal where site welding is required.

3.02 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
- D. Perform field welding in accordance with AWS D1. 1.
- E. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

3.03 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: ¼-inch, non-cumulative.
- B. Maximum Offset from true Alignment: ¼-inch.

3.04 PAINTING

- A. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.
- C. Clean surfaces to be painted in accordance with the manufacturer before applying paint or surface treatments. Program cleaning and painting so that contaminants from cleaning process will not fall on wet, newly-painted surfaces.
- D. Mix, prepare and store painting materials in accordance with manufacturer's directions.

- E. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- F. Do not apply material when surface and ambient temperature are outside the temperature range required by the paint product manufacturer.
- G. Do not apply exterior coatings during rain, fog, or snow, or when relative humidity is outside the humidity ranges required by the paint manufacturer.
- H. Provide special, temporary ventilation and any other protective measures as required by the paint manufacturer and/or applicable laws and regulations.
- I. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing, or replacing and repainting as acceptable to Owner. Provide "Wet Paint" signs to protect newly-painted wet finishes.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Counterflashings and sill pans.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- B. Submit two samples 6 x 6 inch in size illustrating metal finish.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA standard details and requirements unless specific conflicting standards are referenced in this Section.

1.4 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal flashing work with three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials which may cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Galvanized Steel: ASTM A446, Grade A, G90 zinc coating; 24 gage core steel.
- B. Stainless Steel: 26 gage core steel.

2.2 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers; expansion shields for fastening into concrete.
- B. Underlayment: ASTM D226, No. 15 asphalt saturated roofing felt.
- C. Protective Backing Paint: Bituminous, acid and alkali resistant type; black color.
- D. Joint Sealer: Urethane base, one-part or two-part, non-sag, ASTM C920, Type M or Type S, Grade NS, Class 25, Use NT; colors as selected.
- E. Plastic Cement: ASTM D4586, Type II.
- F. Solder: ASTM B32; 50/50 type.

2.3 COMPONENTS

- A. Accessories: Profiled to suit sills and flashings shown on drawings.

2.4 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects detrimental to appearance or performance.
- B. Fabricate cleats of same material as sheet, minimum 2 inches wide, interlockable with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with batten type seams except corners.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend minimum 4 inches horizontally over roofing membrane. Return and brake edges.

- I. Install felt separator trimmed to size in single layer between sheet metal and substrate.
Nail in place.

2.5 FINISH

- A. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing terminations are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.

3.3 INSTALLATION

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Lock seams and end joints. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.
- E. Counterflash mechanical and electrical items projecting through membrane roofing.

END OF SECTION

SECTION 07650

FLEXIBLE SHEET FLASHING

1 GENERAL

1.1 SECTION INCLUDES

- A Wall Flashing at door & louver frames.
- B Wall flashing at base
- C Roof underlayment

1.2 SUBMITTALS

- A Submit under provisions of Section 01300.
- B Product Data: Submit literature and illustrations to indicate the performance and product variations.
- C Submit two samples 4 x 12 inch in size of specified material.

1.3 DELIVERY, STORAGE, AND HANDLING

- A Deliver, store, protect and handle products to site under provisions of Section 01600.
- B Deliver clearly labeled, undamaged materials in the manufacturer's unopened containers.
- C Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.
- D Store materials in a clean, dry location, protected from weather and abuse.

1.4 ENVIRONMENTAL REQUIREMENTS

- A Do not apply flashing when the substrate surface temperature is below 45 degrees F. A

2 PRODUCTS

2.1 MANUFACTURER

A Protecto Wrap Co –

1. Wall flashing - PW 100/40
2. Roof underlayment – Rainproof 40 High Performance Roof underlayment

B Grace Construction Products.

1. Wall Flashing - Perm-a-barrier wall flashing
2. Roof underlayment – Grace Ultra

C Polytite Manufacturing Corp

D Carlisle Coatings & Waterproofing, Inc.

E Substitutions: Under provisions of Section 01600.

2.2 MATERIAL

A Wall Flashing: Synthetic rubber-based, polyethylene backed, with the following characteristics:

1. Thickness: 40 mils.
2. Tensile Strength of Reinforcement: 1400 psi, ASTM D412.
3. Elongation of Rubber Base: +200 percent, ASTM D412.
4. Permeance: 0.1 perms maximum, ASTM E96.

B Roof Underlayment

1. Thickness: 40 mils
2. Tensile Strength: 800 psi ASTM D412
3. Elongation: 500% ASTM D412
4. Puncture Resistance: 150 psi ASTM E154
5. Permeance: .1 perms ASTM E96

C Surface Primer: As recommended by manufacturer.

3 EXECUTION

3.1 PREPARATION

- A Remove dust, loose fibers, and other materials that may interfere with adhesion to the substrate.
- B Prime surfaces as required by manufacturer.

3.2 APPLICATION

- A Install sheet flashing in accordance with manufacturer's instructions.

- B Apply sheet flashing at lintel angles and thru wall flashing.
- C Apply flashing by pulling release paper for 6 inches from the edge and adhering it to the substrate. Continue to pull away the release paper, and rub the surface of the flashing lightly to insure proper contact with the substrate.
- D Lap end joints a minimum of 2 inches in the direction of water flow and seal watertight.

3.3 CLEANING

- A Remove scraps and release paper from the area, and dispose of properly.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.

1.2 SUBMITTALS

- A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- B. Samples: Submit two samples each, illustrating sealant colors for selection.
- C. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.3 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.5 WARRANTY

- A. Provide five year warranty under provisions of Section 01700.
- B. Warranty:
 - 1. Include 5 year coverage for installed sealants and accessories which fail to achieve water tight seal and exhibit loss of adhesion or cohesion, or do not cure.
 - 2. Additionally provide 20 year warranty for silicon sealants for non-staining and weather seal.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Dow Corning.
- B. Bostik Construction Products.
- C. Mameco International, Inc.
- D. Pecora Corporation.
- E. Products Research and Chemical Corporation.
- F. Sika Corporation.
- G. Sonneborn Building Products.

2.2 SEALANTS - INTERIOR

- A. Acrylic Emulsion Latex (Exposed): ASTM C834; Single component, non-staining, non-bleeding, non-sagging, paintable; color as selected.
 - 1. Elongation Capability: 7.5 percent
 - 2. Service Temperature Range: 2 to 160 degrees F.
- B. Butyl Sealant (Concealed): Single component, solvent release, non-skinning, non-sagging, paintable, color as selected.
 - 1. Elongation Capability: 7.5 percent
 - 2. Service Temperature Range: -13 to 180 degrees F.

2.3 SEALANTS - EXTERIOR

- A. Polyurethane Sealant (Horizontal Joints) at Paving: ASTM C920, Grade P, Class 25, Use T; multi-component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-levelling type; color as selected.
 - 1. Elongation Capability: 25 percent.
 - 2. Service Temperature Range: -40 to 180 degrees F.
 - 3. Shore A Hardness Range: 25 to 40.

- B. Silicone Sealant (Exterior Wall Joints): Dow Corning 795 Silicone Building Sealant only – color as selected from full range..

2.4 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, plastic or rubber, closed cell foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- E. Compressible Filler: Closed cell polyester polyurethane; oversized 50 percent to joint width; self-expanding; twice the width of joint, depth of 1-1/2 times the compressed width, by maximum lengths; *Greyflex* manufactured by Emseal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions.
- D. Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.

- B. Measure joint dimensions and size materials to achieve 2:1 width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Compressible Filler: Install according to manufacturer's recommendations.

3.4 CLEANING

- A. Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

END OF SECTION

SECTION 08100

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WARRANTY

- A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 1. Indentations, rust, and surface defects.
 - 2. Inadequate or misplaced hardware reinforcement.

1.02 SUBMITTALS

- A. **SHOP DRAWINGS:** Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances. In addition, provide the following details:
 - 1. **FULL SCALE SECTION OF FRAME:** Show corner joint construction, jamb anchors, plaster boxes, typical hinge mortises with reinforcement, and floor clip angles.
 - 2. **FULL SCALE CORNER SECTION OF DOOR:** Show edge construction, internal reinforcement, sound deadening, and glass stops.
- B. **PRODUCTS DATA:** Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
- C. **TEST RESULTS:** In addition to the fire rated labels specified, provide test results indicating resistance to 450F above ambient temperature for 30 minutes exposure on stairway enclosure.

1.03 SHIPPING, STORING, AND HANDLING

- A. Protect doors during transit, handling, and storage to prevent damage, soiling, and deterioration.
- B. Store in a dry location and stack in accordance with manufacturer's instructions.

1.04 MINIMUM COMPLIANCE STANDARD

National Association of Architectural Metal Manufacturers; Standard CHM-1-74.

PART 2 - PRODUCTS

2.01 CONSTRUCTION CLASSIFICATION

- A. Provide "Custom" grade construction, details, and features except where "Standard" construction meets requirements.

- B. APPROVED MANUFACTURERS:
 - 1. Member Companies of the Steel Door Institute.
 - 2. Tex-Steel Corp., Harlingen, Texas.
 - 3. Overly Manufacturing Co., Los Angeles, California.
 - 4. Williamsburg Steel Products Co., Brooklyn, New York.
 - 5. Pearland Industries Inc., Houston, Texas.
 - 6. Amweld Division of the American Welding and Manufacturing Co., Niles, Ohio.

2.02 FINISHES:

- A. SHOP PRIMER:
 - 1. PREPARATION: Clean and treat surfaces with a chemical system similar to "Bonderizing" to provide for good primer adhesion.
 - 2. PRIMER: Provide rust inhibiting type.
 - 3. PRIMER PERFORMANCE: ASTM B 117 with 200 hours in 5% salt spray to protect against rust for six months when exposed to a normal industrial atmosphere free of continuous contact with wet materials.
 - 4. LOCATIONS: Interior doors and frames.

- B. GALVANIZED FINISH:
 - 1. OPTIONAL FINISH:
 - a. HOT DIPPED GALVANIZED: Comply with ASTM A 525.
 - b. ELECTRO-GALVANIZED: Comply with ASTM A 164 after fabrication.
 - 2. TOUCH-UP: Where damages occur in fabrication or handling touch-up with zinc rich primer so all portions have equal corrosion resistance.
 - 3. PAINT PREPARATION: Treat exposed surfaces with a chemical system similar to "Bonderizing" to provide for good paint adhesion.
 - 4. LOCATIONS: Exterior doors and frames.

2.03 DOOR CONSTRUCTION

- A. SEAMS: Provide full flush construction with edge seams, or seamless.
- B. FACE PANEL GAGES: Minimum of 18 gage (.0449 inches) or typically, with minimum of 20 gage (.0344 inches) when fully bonded to a solid structural mineral core.
- C. INTERNAL CONSTRUCTION: Contractor's option of construction.
 - 1. Steel stiffeners 6 inches on center maximum with sound-deadening, in organic, non-combustible batts.
 - 2. Polyurethane.
 - 3. Mineral cores.
- D. TOP AND BOTTOM EDGES: Provide watertight metal caps for tops of exterior doors and flush bottom closures where required for weather stripping.
- E. HARDWARE REINFORCEMENT: (Minimum steel thickness)
 - 1. 10 GAGE: Hinges.
 - 2. 12 GAGE: Closers, hold-open arms.
 - 3. 14 GAGE: Locks, bolts, panic devices.
 - 4. 16 GAGE: Pull plates and bars (omit with thru-bolt).
- F. HARDWARE COORDINATION: Prepare for hardware under Finish Hardware Section by mortising, reinforcing, and tapping according to template. Drill and tap holes for surface mounted hardware in the field.
- G. GLASS LIGHTS: Provide glass lights as shown on the door schedule for units having glass panels. Glass shall be as specified in Glass and Glazing Section.
- H. DOOR LOUVERS: Stationary; welded blade to frame construction, inserted into door panels, not pierced into the face sheets.
 - 1. FRAME: 20 gage.
 - 2. BLADES: 24 gage.
 - 3. MATERIAL:
 - a. INTERIOR LOUVERS: ASTM A 366 steel, shop primed.
 - b. EXTERIOR LOUVERS: ASTM A 525 steel, galvanized, G60 coating.
 - 4. SCREENS: Provide removable screens for all louvers on exterior-to-interior doors.

2.04 FRAME CONSTRUCTION

- A. GENERAL DESIGN:
 - 1. FRAME SECTION: Provide jamb depths, trim, profile, and backbends as shown on

the Drawings.

2. STOPS: Provide stops with minimum depth of 5/8 inch, mitered, or butted in tight

contact.

3. GAGE: 16 gage (.0568 inches) typical. Provide heavier when required for fire ratings.
4. TRIM FACES: Provide mitered, coped and continuously welded trim faces with welds ground smooth.
5. SILENCERS: Provide minimum 3 per opening on single leaf doors and 4 per opening on double doors. Use Glynn-Johnson GJ64 or similar rubber-tipped silencers.
6. TEMPORARY SPREADERS: Provide "wide-X", or "double-X" shaped spreaders for frames with depths over 5-1/2 inches.

B. FRAME ANCHORS:

1. GENERAL: Design frames specifically to suit various conditions of installation. Attach anchors to frames.
2. FLOOR ANCHORS: Use floor anchors typically. Substitute base anchors where floor anchors are unsuitable.
3. JAMB ANCHORS: Provide 4 anchors per jamb.

C. FRAME REINFORCEMENT:

1. GENERAL: When reinforcement is deformed into extruded shaped holes the reinforcement thickness may be reduced provided equal thread number occurs at holes.
2. THICKNESS: Same as specified for doors.

2.05 FIRE RATINGS

A. LABELS:

1. Where indicated, provide labeled door, hardware, and frame assemblies tested and approved by Underwriters' Laboratories.
2. Other nationally recognized testing agencies may be used if their ratings are accepted without penalties by the code and insurance authorities.
3. If the selected manufacturer cannot fabricate a fire rated product of the size shown, use another manufacturer that can provide the rating.

B. DESIGN: Comply with NFPA Standard No. 80.

PART 3 - EXECUTION

3.01 INSTALLATION

- A.** Anchor frame at each jamb to prevent twisting. Provide temporary spreader until frames are firmly built-in.

- B. Install doors plumb and level without binding, racking, or twisting. Doors shall not fall open or closed. Provide uniform clearance at jambs and head.

- C. Coordinate hardware installation for proper door operation. Adjust locks and latches to engage snugly without forcing. Align hardware to function without squeaking, binding, or racking.

END OF SECTION

SECTION 08700

FINISH HARDWARE

PART 1 - GENERAL

1.01 SCOPE

WORK SPECIFIED ELSEWHERE: Hardware for the following are included with the items as assemblies and are not part of this Section.

1.02 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
- C. SAMPLES: Submit properly labeled samples of hardware for review, when requested. Samples submitted will be returned, or if approved delivered to the job for installation.
- D. TEMPLATES: As soon as installation schedules are returned without exception, furnish required template information to the various manufacturers for fabrication purposes.

1.03 WARRANTY

- A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following;
 - 1. Rough or difficult operation.
 - 2. Noisy operation.
 - 3. Loose or missing parts.
 - 4. Noticeable deterioration of finish.

1.04 MINIMUM COMPLIANCE STANDARDS

GOVERNING DOCUMENTS: The following Documents govern the Work except where more restrictive requirements are specified.

- 1. NFPA Pamphlet No. 101.

2. ANSI A117.1.
3. NFPA No. 80.
4. UL Certification.
5. ADA Accessibility Guidelines for Buildings and Facilities.

PART 2 - PRODUCTS

- A. **PACKING AND MARKING:** Package each item of hardware separately. Mark each package with item number corresponding to item number shown in the hardware schedule.
- B. **KEYING:**
 1. Furnish cylinders with construction cores.
 2. Confer with Owner for precise keying requirements.
 3. Stamp master and master keys. "Do Not Duplicate".
 4. Furnish (3) keys each set.
 5. Furnish (10) key blanks.
 6. Furnish (1) key cabinet and (2) tag filing systems for 120% of all locks furnished.

2.02 MANUFACTURERS AND MATERIALS

- A. Listed materials have been selected from the first named manufacturer's catalogs. Comparable materials by other named manufacturers are acceptable.
- B. Finish symbols, not identified as government or BHMA finish symbols, are manufacturer's finish symbols.
- C. **BUTT HINGES:**
- D. **CLOSERS:**
- E. **EXIT DEVICES:**
- F. **LOCKSETS:**
- G. **BOLTS, STOPS, HOLDERS, AND SILENCERS:**
- H. **THRESHOLDS AND SEALS:**

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with the manufacturer's templates and printed information.

- B. Adjust closers. Check locks, latches, and other operating mechanisms for ease of operation.
- C. Change cylinder locks and furnish keys just prior to time of building acceptance.

PART 4 - SCHEDULES

- A. Refer to drawings for hardware sets

END OF SECTION

SECTION 09260

GYPSUM BOARD SYSTEMS

1 GENERAL

1.1 SECTION INCLUDES

- A Metal stud wall framing.
- B Metal channel ceiling framing.
- C Gypsum board.
- D Taped and sanded joint treatment.
- E Texture finish.

1.2 SUBMITTALS

- A Submit under provisions of Section 01300.
- B Product Data: Provide data on metal framing showing gage selection, gypsum board, joint tape; decorative finish.
- C For the exterior sheathing, provide manufacturers fastening pattern that meets or exceeds the requirements for the wind pressures of the exterior wall.

1.3 QUALITY ASSURANCE

- A Perform Work in accordance with ASTM C754, GA-216, and GA-600.
- B Provide stud depths as shown with gage and spacing as required to limit deflection to L/240 at 5 psf uniform load
- C Conform to ASTM C754 and manufacturer's recommendations for limiting height.

1.4 QUALIFICATIONS

- A Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

2 PRODUCTS

2.1 FRAMING MATERIALS

- A Studs and Tracks: refer to section 05410 for 16 ga material; size as shown on Drawings.
- B Furring, Framing and Accessories: ASTM C645.
- C Anchorage to Substrate: Tie wire, nails, screws and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- D Adhesive: ASTM C557.

2.2 GYPSUM BOARD MATERIALS

- A Moisture Resistant Gypsum Board: ASTM C630; 5/8 inch thick, maximum permissible length; ends square cut, round edges.

2.3 ACCESSORIES

- A Corner Beads: Metal.
- B Edge Trim: GA 201 and GA 216.
- C Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, and water.
- D Fasteners: ASTM C1002, Type S12.

3 EXECUTION

3.1 EXAMINATION

- A Verify site conditions under provisions of Section 01039.
- B Verify that site conditions are ready to receive work and opening dimensions are as instructed by the manufacturer.

3.2 METAL STUD INSTALLATION

- A Install studs in accordance with GA-201, GA-216, and GA-600.
- B Metal Stud Spacing: 16 inches on center maximum.

- C Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- D Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- E Blocking: Screw attach wood blocking to studs.

3.3 CEILING FRAMING INSTALLATION

- A Install in accordance with GA 201 and GA 216.
- B Coordinate location of hangers with other work.
- C Install ceiling framing independent of walls, columns, and above ceiling work.
- D Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
- E Laterally brace entire suspension system.

3.4 GYPSUM BOARD INSTALLATION

- A Install gypsum board in accordance with GA-201, GA-216, and GA-600.
- B Erect single layer gypsum board vertically, with ends and edges occurring over firm bearing.
- C Use screws when fastening gypsum board to metal furring or framing.
- D Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
- E Treat cut edges and holes in moisture resistant gypsum board with sealant.
- F Place control joints consistent with lines of building spaces at 30 ft oc maximum and:
 1. At substrate construction changes within plane of wall.
 2. At doors less than full height locate at outside hinge edge of frame.
- G Place corner beads at external corners as indicated. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.5 JOINT TREATMENT

- A Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- B Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- C Taping, filling, and sanding is not required at surfaces behind ceramic tile.

3.6 TEXTURE FINISH

- A Roller or spray apply finish texture coating in accordance with manufacturer's instructions; fine orange peel texture.

3.7 TOLERANCES

- A Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09624

RUBBER FLOOR PADS

PART 1 - GENERAL

1.01 WARRANTY

- A. Warrant the Work specified herein for five years against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.
- B. Defects shall include, but not be limited, to the following:
 - 1. Warping, buckling, shrinking, or cracking.
 - 2. Softening or discoloring.
 - 3. Coming loose.

1.03 SUBMITTALS

- A. SAMPLES:
 - 1. SELECTION: Submit full range of colors, patterns, textures, and finishes available for selection.
 - 2. APPROVAL: Submit two selected samples for final approval in sizes described in Division 1.
- B. LAYOUT: Provide layout of floor tiles for review by Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. RUBBER PADS:
 - 1. APPROVED MANUFACTURER: Pawling Corporation, (800) 431-3456.
 - 2. PRODUCT: P-40
 - 3. SIZE: 4' x 6'
 - 4. THICKNESS: 3/8 inch.
 - 5. PATTERN: Non-interlocking.
 - 6. ADHESIVE: As recommended by manufacturer.
 - 7. ACCESSORIES: Transition strips as required.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Proceed only when conditions are suitable for satisfactory performance of this Work.
 - 1. Correct irregularities that may cause a visible fault in the finished flooring, with a maximum irregularity of 1/16 inch per linear foot and 1/4 inch in 8 feet in any direction.
 - 2. Conduct tests for moisture and alkalinity to see that they are below detrimental levels. Reduce alkalinity with acid if necessary, and postpone flooring until moisture levels are tolerable.
 - 3. UNSOUND CONCRETE: Do not lay flooring on patches or other areas showing signs of softness or crumbling.
 - 4. CLEANLINESS: Accept subfloor surface only in perfectly clean condition with all foreign materials removed.
 - 5. CURING COMPOUNDS: Verify with adhesive manufacturer the compatibility of curing compound and adhesive. Conduct adhesive tests in areas indicating excessive build-up of compound.

- B. PREPARATION: Do minor spot patching of chips and minor leveling, particularly at points resilient flooring abuts other materials. Use latex underlayment.

3.02 INSTALLATION

- A. GENERAL
 - 1. STORAGE: Store materials at the job site according to manufacturers literature.
 - 2. INSTALLATION: Install floor material as recommended by manufacturer.
 - 3. FINAL CLEANING: Clean floors as recommended by manufacturer.

- B. LAYOUT:
 - 1. GENERAL: Arrange pads in spaces so edge rows against walls are larger than 1/2 of the tile size.
 - 2. Follow approved joint layout.

- C. BASES AND EDGE STRIPS:
 - 1. Butt ends together to hairline fit. Re-cut edges if necessary.
 - 2. Avoid stretching so joints remain tight.
 - 3. Place base touching floor at all points.
 - 4. Scribe to cut as necessary for precise fit.

END OF SECTION

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.2 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.
- C. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.3 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.4 SUBMITTALS

- A. Product Data: Provide Product Data on all finishing products, if requested by Architect.
- B. Samples: Submit sample fans illustrating range of colors if requested by the Architect.

1.5 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame and smoke rating requirements for finishes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

1.9 EXTRA MATERIALS

- A. Provide 2 new un-opened gallons of each color, type, and surface texture to Owner.
- B. Label each container with color, type, texture in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sherwin Williams
- B. Glidden
- C. Benjamin Moore.

2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate conditions are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application. Beginning installation represents acceptance of conditions and substrates. Test shop applied primer for compatibility with subsequent cover materials.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Concrete: 12 percent.
 - 3. Exterior and Interior Wood: 15 percent, measured in accordance with ASTM D2016.
 - 4. Concrete Floors: 8 percent.

3.2 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Concrete Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- H. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- I. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes, splits, gouges and cracks after primer has dried; sand between coats. Apply caulk in open cracks, inside corners cracks between dissimilar materials.

- J. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- K. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- L. Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- D. Sand metal lightly between coats to achieve required finish.
- E. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat. Allow applied coat to dry before next coat is applied.
- F. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- G. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- H. Apply additional finish coat as needed to hide under-coat colorations or appearances.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Mechanical and Electrical Divisions for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
- B. Paint shop primed equipment.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, and collars and supports except where items are pre-finished.
- E. Paint exposed conduit and electrical equipment occurring in finished areas.
- F. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- G. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names and numbering.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 CLEANING

- A. Clean work. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Metal Fabrications (Section 05500): Exposed surfaces of lintels.

3.7 SCHEDULE - EXTERIOR SURFACES

A. GALVANIZED METAL:

- | | |
|---------|---|
| 1 coat | Zinc dust, cement primer, or epoxy ester
ICI DEVOE DEVGUARD 4120 |
| 2 coats | Alkyd semi-gloss enamel
ICI DEVOE DEVFLEX 4206 |

B. STEEL OR IRON: (Regular primer by fabricator)

- | | |
|-----------------------|---|
| 1 coat | Touch-up of primer |
| 1 coat (Intermediate) | Iron oxide, zinc chromate, or copolymer
base primer ICI DEVOE DEVGUARD
4120 |
| 2 coats (Finish) | Alkyd semi-gloss enamel; door and
frames full gloss. ICI DEVOE DEVFLEX
4206 |

C. EXTERIOR WOOD AND PLASTER:

- | | |
|---------|--|
| 1 coat | Exterior latex (wood) primer. ICI 2010
ULTRA-HIDE DURUS |
| 2 coats | Exterior Satin. ICI 2412 ULTRA-HIDE
DURUS |

D. PAVEMENT: (Parking lines & markings)

- | | |
|--------|---|
| 1 coat | Traffic marking paint (yellow)
4 inch line width |
|--------|---|

3.8 SCHEDULE - INTERIOR SURFACES

A. PAINTED WOOD:

- | | |
|---------|--|
| 1 coat | Oil/alkyd base enamel undercoater
ICI 1120 ULTRA-HIDE |
| 2 coats | WB semi-gloss, ICI DEVOE
DEVFLEX 4206. |

B. GYPSUM DRYWALL:

- | | |
|---------|--|
| 1 coat | Sealer and primer. ICI DEVOE 1030
ULTRA-HIDE PVA. |
| 2 coats | WB semi-gloss. ICI DEVOE
DEVFLEX 4206. |

C. CONCRETE MASONRY UNITS:

1 coat

Heavy duty block filler. ICI DEVOE
3010 ULTRA-HIDE.

2 coats

WB semi-gloss. ICI DEVOE
DEVFLEX 4206.

D. STEEL: (Primed by fabricator)

1 coat

touch-up of primer. ICI DEVOE
DEVGUARD 4120.

2 coats

WB semi-gloss. ICI DEVOE
DEVFLEX 4206.

E. GALVANIZED METAL:

1 coat

Zinc dust, cement primer, or epoxy
ester . ICI DEVOE DEVGUARD
4120.

2 coats

WB semi-gloss. ICI DEVOE
DEVFLEX 4206.

END OF SECTION

SECTION 16012
ELECTRICAL WORK

PART 1 GENERAL

1.00 CONDITIONS

1.01 Contractor shall comply with programming allowance requirements of:

A. Item 1.07 – “Contractor’s Responsibilities” of this specification section.

1. **Item 3.07 – “Field Quality Control” of Section 16662 – “Motor Management Relay”**
2. **Item 1.00 – “Conditions” of Section 16904 – “Controller”**
3. **Item 1.01 – “Work Included” of Section 16904 – “Controller”**

Contractor or his Subcontractors are not responsible for contents of program. Warranty for operation of program is solely the responsibility of the Programmer, Shrader Engineering. There are to be no contractual agreements between the Contractor and/or his Subcontractors and the Programmer, Shrader Engineering. Provide programming allowance per Item 1.07 – “Contractor’s Responsibilities.” Contractor is bound to coordination of various equipment installations and operation so as to not delay scheduled installation and testing of programs. Review all electrical related Specifications for schedule requirements of programming activities.

B. Contractor shall verify requirements of Item 2.01 – “Materials” before bidding.

C. **Contractor to conform to Item 1.06 – “Contractor Qualifications” of this specification before bidding.**

D. General Contractor is solely responsible for coordinating all electrical requirements of all equipment installed under this contract.

E. Electrical Subcontractor shall confirm this with General Contractor before bidding. Within 10 days of “Notice to Proceed,” the General Contractor shall appoint a person responsible for coordination of all electrical controls and equipment that are a part of this project and shall, at that time, notify Engineer in writing of that person’s name, telephone number, fax number, address, and all other pertinent information.

- F. This specification section is an inherent part of all work performed on this project and its contents shall apply for any and all electrical power, control and instrumentation related work. Contractor shall advise all Subcontractors and Vendors accordingly.
- G. Warning: Electrical systems for this project have lethal voltages present. Contractor shall not work on energized equipment except when absolutely necessary and then only in the presence of another trained, experienced Electrician and with proper protective gear. See Item 1.06 – “Contractor Qualifications” for safety training requirements.
- H. All correspondence, RFI’s, and submittals concerning electrical, instrumentation, and controls matters shall be from General Contractor and shall have statement that General Contractor has verified the correctness or validity of the correspondence, etc. in respect to contractual requirements of the plans and specifications. Any correspondence, etc. not having this statement or determined to be covered in the requirements of the plans and specifications will not be responded to and the Contractor shall be fully responsible for any action or non-action thereof.
- I. All references to “days” in the electrical, mechanical, instrumentation, and controls specifications means “working days.” All prequalification under this specification shall be submitted no later than ten (10) days prior to bid date.
- J. Installation shall conform to most recent National Electrical Code, International Building Code, and Local Codes. In addition, Contractor shall follow all requirements of NFPA 70E - “Standard for Electrical Safety in the Work Place.” Of specific importance are all the requirements of Article 400.11 – “Flash Protection.”
- K. Plans and diagrams are illustrative and may not contain all devices wiring and controls required to perform the function intended without reference to Specifications. Location and alignment of motor control centers or other equipment shown on Plans may require adjustment for some Equipment Manufacturers products, and this requirement is the Contractors sole responsibility.
- L. Substitutions for equipment specified or shown on plans shall be as pre-approved prior to bidding unless specified or shown on plans as “or equal.” Where noted as “pre-approved,” indicates approval is required prior to bid acceptance.
- M. All software or programs provided by any Vendor or Contractor shall be open activation without undisclosed passwords, keys, and/or means or devices that prevent Owners access to programs. All software shall be new copies for Owner with no cost attachments. No exceptions.

- N. All references to plans and/or drawings refer to the complete set of contract plans and not specifically electrical only, unless stated otherwise.
 - O. Additions or modifications to existing facilities involves a degree of uncertainty and all existing, hidden or unknown conditions may not appear on plans. Contractor is to consider this when bidding and shall cover all reasonable unknown conditions not evident in pre-bid site visit, which is necessary to familiarize Contractor with observable pre-existing conditions. Contact Engineer concerning any questions prior to bidding job.
 - P. Control panels, MCC's and electrical equipment shall be fabricated to fit the available space shown on plans. Install control panels, instruments, and motor control centers to allow a minimum of four (4) foot clearance for access to control devices. This may require special enclosures. Relocation up to 40 feet from where shown on plans may be required and shall be included in bid cost. Supplier and Contractor shall notify Engineer of any variations in size, location or orientation before fabricating equipment. Listing of acceptable Equipment Manufacturers does not limit or remove the intent of this requirement.
 - Q. All devices, fittings, connectors, supports, brackets, and miscellaneous hardware normally used for installation of electrical equipment may not be shown in detail. Contractor shall provide all these items and included them in bid price.
 - R. Any change orders or additional work beyond the scope of this project as bid by Contractor shall be approved in writing by Engineer. Any unapproved work performed is at Contractor's risk.
 - S. Installation shall conform to layout, routing, and details shown on Plans and described in Specifications. Any variations shall be pre-approved in writing by Engineer before work starts. Any unauthorized work shall be removed at Contractor's cost and with no delay in project schedule.
- 1.02 DESCRIPTION
- A. The work shall include providing materials and equipment required for installation of a complete and functioning electrical system as specified and as shown on the drawings.
 - B. This section is an integral part of all Specification Sections related to electrical, control and instrumentation construction under this contract. Contractor shall check all other plans and specifications for this project and include items and circuits accordingly.

The total set of construction documents make up the requirements for work for this project and shall be included in Contractor's bid at no additional cost to Owner or Owner's Representative.

- C. All plans and specifications for this project are representative of the design intent and may not contain minute details associated with normally accepted electrical construction, as described in applicable codes or as described in manufacturer's literature. Contractor shall provide all appurtenances normally associated with a particular equipment or device, and as required for a proper operating system. Some devices, equipment or materials may appear in only one location on the plans or in the specifications. Each and every item shown or described is to be included for this project. No exceptions. All required circuits and devices necessary for intended operation are to be included without additional cost to Owner. Where discrepancies occur between various plans or specifications for this project and where clarification is not requested by Contractor prior to bidding, the most stringent requirement shall be included in the Contractor's bid price. Contractor shall review all specifications for all trade disciplines with electrical requirements prior to bidding and shall include most stringent and higher cost requirements in bid price. No elements or requirements of the plans or specifications shall be omitted in Contractor's bid price unless specifically deleted in writing by Engineer. Failure to follow this specification requirement is at Contractor's expense and at no additional cost to Owner.
- D. Prior to bidding and during construction, Contractor shall coordinate with equipment vendors and suppliers and determine requirements for power, control and interconnection wiring and shall provide conduits and conductors accordingly for a complete operating system.
- E. All electrical work shall be performed only by a Texas State Licensed Electrical Contractor, and as listed in Item 1.06 – "Contractor Qualifications" of this Section.

1.03 MAJOR ITEMS OF WORK AS FOLLOWS

- A. All work shown on plans and described in specifications including as follows:
 - 1. Installation of motor control center.
 - 2. Installation of lighting and receptacles.
 - 3. Installation of pump motor feeders.
 - 4. Installation of electrical service equipment and automatic transfer switch.

5. Installation of autosensory controls with solidstate pump controller.
 6. Installation of telephone service and automatic telephone dialer.
 7. Installation of all other miscellaneous electrical systems, as shown on plans.
- B. Contractors shall attend coordination meeting with Engineer to review construction methods, plans and specifications before starting work. Prior to start of work, Contractor to provide schedule showing all phases of work, including completion, testing and required programming schedule as described in Item 3.08 – “Testing and Startup,” of this specification.

1.04 PLANT CONTROL SYSTEM

- A. The Contractor shall furnish and install a complete operating control system. The control system shall include but shall not be limited to all circuit breakers, motor starters, alternator, contactors, indicating lights, selector switches, surge protector, phase failure relays, programmable controllers, alarm light and horn, push buttons, control transformer, electronic devices, sensors, interlock wiring, control relays, blocks, snubbers, valves, nameplates, and all other associated items required to provide a workable system. All control circuits to be “fail-safe” type. All blower controls to have low pressure alarm indicator per state requirements.
- B. Provide circuit conductors, conduits, circuit breakers, and related devices for furnishing power to all motor heaters, instruments, devices, lights, controls, and all other motors and equipment indicated on plans or provided by Vendors or others for this project. Provide circuits and related devices per Code.
- C. All controls shall be fully tested in shop for proper and satisfactory operation, prior to installation at site. Contractor to provide written certification before delivery to site. Any installations without certification notice are done at risk by Contractor, who shall be obligated to make all necessary corrections in field at no additional cost to owner.
- D. Where any equipment includes a Manufacturer furnished control panel the Equipment Vendor or Manufacturer shall be responsible for coordination of all interconnecting wiring at related devices.
- E. Provide interlock circuits between vendor furnished equipment, control panels and lift pump starters. This includes interlock between lift pump and screen controls.

Coordinate with each vendor. Do not submit control panels until interlocks are coordinated. Provide interlock circuits with adjustable time delay devices.

- F. Provide block and bleed valves for level and pressure devices. Route bleed line to outside building or enclosure.
- G. All multiple pump installations shall have means of alternating pumps and provisions for bypassing pumps not in service in primary and backup mode of operation.
- H. All CT's to have means for limiting voltage level at CT terminals in event load disconnected while CT is energized. This is required for personnel safety.
- I. All control device settings are to be adjusted by Contractor for values recommended by the Plant Operator. Contact Engineer if clarifications needed.

1.05 CONTRACTOR QUALIFICATIONS

- A. Contractor, Subcontractors, and Controls Vendors shall be experienced with all types of electrical systems covered under this contract. No work shall be undertaken where Contractor's firm, project supervisors and project electrical workers have not had recent experience in similar projects in area of project location. Electrical contractors, electricians, inspectors, installers, and programmers assigned to this project shall be full time qualified employees. Contract type employees are not allowed unless preapproved by Engineer. Contractor will be required to furnish proof of experience and employment where requested by Owner or Engineer or their Representatives. Pre-qualified Electrical Contractors are listed in Item 1.06, Paragraph E of this section.
- B. Contractor's Project Manager or his Assistant shall be familiar with types of electrical construction required by this project in order to determine that all subcontractor and vendor's work is in conformance with the plans and specifications.
- C. Electrical Contractor shall have Master Electrician License for City or County; in which project is located, and shall have a State issued Master Electrician License.
- D. Contractor shall have an established safety-training program in effect for the duration of this project and will be required to submit proof of safety training for all employees working on this project.

- E. The following Contractors are considered qualified and acceptable for electrical construction:
1. Pfeiffer & Son, Ltd.
 2. W.W. Payton
 3. SECO
 4. McDonald Electric, Inc.
 5. Systems, Inc.
 6. Industrial Electrical Services (IES)
 7. Electrical Automation Controls (EAC)
 8. Boyer, Inc.
 9. Resco Electric, Ltd.
 10. Clarion Electrical

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor shall coordinate electrical power, natural gas, telephone, data, or special purpose line installation with utility companies. Within 30 days after award of contract, the Contractor shall contact utility company and Owner and shall request service needed. It is Contractor's sole responsibility to assure that utility company and Owner are notified and are kept aware of requirements.

Advise Owner of exact voltage and phase service required when completing application for service. Owner and Engineer shall be advised in writing of Utility Company Service Representative handling service order, telephone number, address and order number within 30 days of Contract Award and notice to proceed. Contractor shall notify Engineer and Owner of proposed service poles to be installed by Power Company and Contractor and shall include copy of "Outlet Location Data Statement" from Power Company before installing poles or conduits.

Delays in services installed due to failure to make timely application shall be at Contractor's expense.

- B. Contractor shall provide all conduit, conductors, and termination equipment as needed for utilities and shall coordinate with utility companies for installation requirements and shall provide installation constructed according to the utility company standards whether or not such is shown in detail or plans. Where underground service is provided by Utility Company, the Contractor shall provide service installation accordingly and shall allow for up to 100 feet of underground feeder ductbank. Work shall include all equipment and materials required for working service.
- C. Contractor shall review all sections of the plans and specifications for this project and shall note all electrical requirements for devices and equipment shown or implied, and shall provide service accordingly for a complete operating control system. Any discrepancies in Electrical or Mechanical requirements noted in various plans and specifications shall be brought to the attention of the Engineer prior to ordering equipment or materials or prior to starting construction related to the item in question. Coordination of all equipment and systems is Contractor's sole responsibility. Failure to coordinate all equipment requirements shall be the responsibility of the Contractor, at no additional cost to Owner.
- D. Unless specifically noted otherwise, Contractor shall furnish all software. Programming will be performed by the Shrader Engineering Systems Integration Engineer as required in Section 16904 – "Controller", or other applicable sections included for this project and, where programming is required. Contractor shall provide an "Allowance" in bid cost. Where "Allowance" amount is not shown on bid sheet, contact Shrader Engineering at (713) 467-9961 for the cost. Provide fax number in order to receive "Allowance" conformation from Systems Integration Engineer. Failure to provide this "Allowance" is at the expense of the Contractor and at no additional cost to Owner. Contractor shall provide all installation, set-up, adjustments and testing of devices or equipment included under this contract.

Contractor is not responsible for installation or operation of program. Warranty for programming is solely the responsibility of the Programmer and is exclusive of the Contractor's agreement with Owner, full allowance is required before final acceptance and is not subject to "retainage" withholding.

- E. Programs will be loaded by Programmer during Engineer's shop testing of system at fabricators facilities. A program will be downloaded for testing and the final program will be downloaded upon receipt of allowance payment. Programmer is not responsible for any delays due to non-compliance by Contractor.

- F. Contractor is specifically responsible for coordination of all electrical, mechanical, and process systems, devices and equipment provided or installed under this contract and shall assure that all requirements by all trades are met such as to insure a complete and operating electrical, control, process or instrumentation system. Special attention shall be given to coordination of motors supplied, MCC components supplied, mechanical systems supplied, horsepower and voltage and phase requirements of each. Where motor horsepower varies from plans, Contractor shall adjust circuit and control devices accordingly. This includes verification of compatibility of all interfacing connectors and devices at new, existing, and Owner furnished equipment. Notify Engineer of any discrepancies before ordering equipment. Failure to do so may result in additional cost to Contractor.
- G. Contractor shall assure that all systems have been properly installed, adjusted and tested prior to final inspection and shall notify Engineer at time electrical installation is ready for final inspection and testing.
- H. Unless Engineer has been duly notified in writing that equipment is not ready for final testing and such is acceptable with Engineer, additional final inspections and testing will be at Contractor's expense and at no additional cost to Owner.
- I. Contractor shall fully inspect all motors and nameplates, controls, conduit, wiring devices and other items before starting work, ordering materials, or submitting shop drawings in order to verify existing conditions are as shown on plans and, shall immediately notify Engineer of any discrepancies between plans and specifications and existing conditions. Failure to do so may result in Contractor's responsibility for any required changes in construction. This includes verification of compatibility of all interfacing connectors and devices for new, existing, and Owner or Contractor furnished equipment. Notify Engineer of any discrepancies before ordering equipment.

Where available review "Record" drawings before bidding where existing conditions are unknown. Where available refer to "Record" drawings during construction of this project. Note that "Record" drawings may not be available in which case Contractor is required to determine wiring connections and device types as part of this contract. Where Manufacturer's delivered motor size varies from design size shown on one-line diagram or, described in specifications, Contractor shall provide conductors, conduits, and all motor control devices sized for the delivered motor size at no additional cost to Owner. Where motor current transducers are required for use by Manufacturer control panels, Contractor to provide current transducers and conductors sized by Control Panel Manufacturer at no additional cost to Owner.

- J. When work involving modifications or additions to existing plant will interrupt normal service, Contractor shall make provisions for continuous electrical service thru Contractor furnished standby generator power. Where a standby generator exists but will be temporarily out of service during construction, Contractor shall provide substitute generator power for duration of outage. In no event shall plant be without operating power or, without standby generator service. Include all transfer switches, fuel tank, fuel, attendance and appurtenances required for a complete power system as needed for interim plant operation. Where work disrupts power and/or control to new or existing equipment, furnish temporary bypass circuits, as required, to maintain equipment operation.
- K. Where power outage is required, it shall be coordinated with Operator and Engineer. An outage shall not exceed 4 hours. Contractor shall plan work and provide equipment as required to maintain electrical power to facilities.
- L. Where work involves additions, modification, demolition, or renovations to existing facilities, Contractor shall remove, relocate, and extend existing installations to accommodate new construction. This includes relocation of conduits, equipment and materials that may obstruct placement of new equipment. Existing spare conduits and equipment may not be located at exact place shown on plans. Relocations and adjustments up to 40 feet are required as part of this contract. Where spare buried conduits are to be reused, conduits shall be cleaned out of all debris before use.
- M. It further includes extension or modification of existing circuits that are related to work covered under this project. Route all existing alarms to autodialer, alarm panel, and PLC where available. Include all conduit and wiring. Extend all existing power and control circuits as required for proper operation of electrical systems. This includes extension of pump cables and instrument cables, which may require in-place splicing.
- Contractor shall field observe existing conditions prior to submitting a bid to become familiar with existing conditions and shall account for any relocations or extensions in bid. Refer to "Record" drawings and existing O&M Manuals. Failure to do so is at Contractors' risk and at no additional cost to Owner.
- N. Provide electrical circuits to all equipment as required by manufacturer. Verify location and characteristics of all equipment shown on plans and in specifications and size circuits accordingly. All conductors and conduits to comply with NEC Article 250 and Article 310. All terminations to vendor furnished control panels shall be done by Contractor, unless specifically noted otherwise on plans or in specific specification sections. All panel calibrations and adjustments shall be done by Vendors Representative.

When preparing bid or when performing work, observe all plan sheets for vendor furnished equipment and provide all required interface wiring between various panels and/or equipment necessary for a complete operating system. Provide electrical circuits to all equipment, devices, controls, controllers, and other items shown on plans, or described in specifications. Provide circuit breaker, conductor, local disconnects, and connections to equipment in compliance with National Electrical Code. All circuits may not be shown on plans and must be verified and installed accordingly.

- O. Where any equipment performance does not conform to specifications or, where in Engineers opinion, parameters are out of tolerance or erratic in performance, the Contractor shall remove and replace equipment at no additional cost to Owner.
- P. Location of outlets and equipment shown on Drawings is approximate. Field verify exact location. Minor modification in location of outlets and equipment is considered incidental up to distance of 40 feet with no additional compensation.
- Q. Provide fail and problem alarms for controls and Manufacturer's equipment. Route circuits to autodialer. Provide circuits, relays, expansion modules, and programming. Route all existing alarms to autodialer where work involves modification or additions to existing equipment.
- R. Contractor shall provide the equipment necessary for locating all underground pipes, conduits, and structures before digging. All locations of intersection shall be properly staked and identified. Locating all underground lines is the sole responsibility of the Contractor and shall be at no additional cost to Owner. Any damage to underground lines is the responsibility of the Contractor. Where obstructions are present in existing spare underground conduits to be used in this project, use video camera to determine cause of obstruction and contact Engineer for directions on how to proceed.

Review all plans prior to bidding and during construction and provide power and control requirements for all valve actuators and Manufacturer furnished panels according to the Engineer's specifications and plans for all equipment. This further includes all starters, breakers, controls, conductors, conduits, interface wiring, and devices for a complete electrical system.

- S. Refer to contract plans and provide local disconnect switches for all motors, heaters, motor operated valves, fans and electrical equipment required for this project per National Electric Code. (Applicable where shown on plans.)

- T. Change orders submitted by Contractor shall include a full technical explanation of request and shall contain statement confirming that Contractor has reviewed all plans and specifications and that all work was coordinated with other trades.
- U. All equipment, devices and other items shown or indicated on plans and described in specifications are to be provided, furnished and installed by the Contractor unless, specifically and clearly marked or noted as “N.I.C.” (Not in Contract). Failure to include all items is at Contractor’s expense and at no additional cost to Owner.
- V. Contractor shall be responsible for maintaining and adjusting all equipment for safe, damage free operation where equipment must be operated by Owner during construction. This especially pertains to existing equipment and controls that may be modified under this contract but are required to be operated by Owner. All valves, motors, and controls shall be properly locked out in a safe position to prevent inadvertent damage by Owner during the course of operating the plant. Contractor shall notify Owner in writing of any equipment that cannot be safely operated.
- W. All requirements for instrumentation and control equipment shall be reviewed by Manufacturer’s Representative prior to shop drawing submittal and, Engineer shall be notified in writing when installation and application indicated on plans may not result in satisfactory and/or accurate operation of equipment specified. Failure to abide by this requirement is at Contractor’s risk and expense.
- X. Do not install fuel tanks within 50 feet of habitable buildings where prohibited by local codes. Field verify with plans before starting work. Notify Engineer of any conflicts. Failure to do so is at Contractor’s risk and at no additional cost to Owner.
- Y. A state licensed Electrician shall be present at all scheduled inspections. No Exceptions.
- Z. Provide all required wire adapters for oversized feeder conductors at panels, switches, breakers, and other equipment.
- AA. Where outdoor conduit top entry to enclosures, provide CSBE seals at top of conduits to avoid water entry. This applies to service bus weatherhead entries and other applications.
- BB. Alarm reporting devices such as automatic telephone dialers shall never be disabled once installed and put in operation or, where already installed at existing facilities. Test autodialer at end of each workday during construction period.

- CC. Methods of work and devices described in all electrical specification sections are intended to facilitate a properly constructed and operating electrical system that meets Owner's operational requirements and satisfies the requirements of local and national codes. The Electrical Engineer may approve methods or devices that vary from the requirements described in any particular specification if, in the Engineer's judgment, the installation meets the intent of the Engineer's design and, where the electrical system performance meets the general requirements of the facility operation and, where the installation is deemed to present a safe installation that does not present a danger to persons operating or maintaining the electrical installation. This variance may be authorized during the submittal or inspection stage of the project, as the Engineer deems appropriate.
- DD. All equipment, conduits, panels, and devices shall be installed in the most strict, professional manner to present a neat installation. Where a question arises concerning intent of method for installation or where details are not clear, Contractor is to contact Engineer for clarification before proceeding with work. Any work not suitable or not installed in a professional manner will be modified to an installation acceptable to Engineer and Owner at no additional cost.
- EE. Provide arc flash warning tags on all electrical equipment where required by NFPA 70E. Submit arc flash analysis for Engineers review.
- FF. All motors, motor control centers, and all other electrical equipment shall be stored in a climate-controlled area prior to installation. Space heaters in motors and equipment shall be energized while stored. After installation space heaters shall be energized at all times. See relevant specification sections for additional requirements. Contractor is liable for any corrosive damage and any defective equipment.

Where Contractor fails to protect electrical equipment before and after installation on site and where excessive dust is observed inside the enclosure, Contractor shall have a factory warranty service technician clean, inspect and test unit, after which factory shall issue a written and signed statement that full factory is in effect. There are no exceptions to this requirement except to replace entire unit at Engineer's request. Any equipment, devices, or software shown or indicated on Contract Documents as required for this project, and that may be overlooked by Owner or Engineer on submittals or at Final Acceptance inspection, shall still be provided by Contractor at no cost to Owner regardless of period of time that expires before Owner requests to be furnished and installed.

- GG. Vendors for equipment with solid-state controller shall include provisions for both hardwired and data path status, command and alarm functions included under contract without additional cost to Owner, Programmer, or Engineer.
- HH. Contactor shall provide all required power, control, lighting, data and instrument circuits from sources to all miscellaneous accessories and equipment that are a normal part of process equipment, electrical equipment, mechanical equipment, generators other packaged systems furnished by manufacturers for this project. Include all materials and labor required for installation of a complete operating system in bid cost, and at no additional cost to Owner. Contractor is to coordinate these requirements with vendors and manufacturers before submitting bid. For generator and process equipment systems, this shall also include fuel source piping, including chemical or other liquid or gaseous sources and all related devices and equipment that are part of a standard or specialized installation for equipment specific to this project.

PART 2 PRODUCTS

2.00 MATERIALS

- A. All materials provided under all sections of the specifications shall be new and the standard products of manufacturers regularly engaged in the production of such equipment. Motor control centers, control panels, controller panels, pump panels, blower panels, and all similar equipment shall be manufactured by a firm located within 200 miles of the project facility or, firm shall have an established full time service and repair facility located within 200 miles of project facility. Final assembly of motor control centers and control panels shall be performed at these local facilities. All materials shall conform to the National Electrical Code and shall be approved by Engineer and listed by the Underwriters' Laboratories.

Materials described by manufacturer's name and catalog number are selected to set a definite standard of design and quality to be required. There is not any intention to discriminate against a product of another manufacturer, which is equally durable in construction, similar in design, and will serve the purpose for which it is intended. All equipment, hardware, materials, motors, towers, masts, brackets, or accessories shall be installed in strict accordance with Manufacturer's instructions. Contractor shall contact Manufacturer's designated local Representative for confirmation of exact model, options, configuration and services that are to be included in bid cost. Manufacturer's Representative shall make all critical adjustments to electronic modules and controls.

Where plans, details, or specifications indicate instructions that are contrary to Manufacturer's instructions, consult with Engineer before ordering or installing. Failure to follow the requirements of this paragraph is at Contractor's expense and at no additional cost to Owner.

- B. Materials and equipment specifications are general in coverage and may contain reference to construction items that apply in only particular situations and may not apply as a general rule for materials installed on this project. Listing of acceptable Equipment Manufacturers does not limit or remove the intent of any specification sections included for this project. Provide all required accessories required by Equipment or Materials Manufacturer for proper installation. Failure to do so is at Contractor's expense.
- C. All equipment and devices shall be installed according to manufacturer's instructions. Coordinate installation with manufacturer's representative to assure correct installation methods have been applied. Prior to submittal review, Manufacturer's Representative shall review plans and specifications and shall notify Engineer in writing where application shown on plans will not provide satisfactory and/or accurate performance. Failure to abide by this requirement shall be at Contractor's risk and cost. All equipment and materials shall be rated for the harsh Industrial, Electrical, and Mechanical environment in which installed and shall be warranted by manufacturer accordingly. **This includes all enclosures located in wastewater and water facilities, including all outdoor control panels, breaker panels, switches, junction boxes, and similar electrical equipment at other facilities which shall be NEMA 4X 316 stainless steel without exception.** This requirement is paramount to all other drawings or specification requirements unless specifically noted or, unless approved otherwise by Engineer in writing.
- D. Outdoor equipment shall not have exposed devices or controls, unless specifically called for on plans. The outer door shall cover all such items. No see thru windows are allowed unless specifically approved.

All outer doors to have locking hasp and door restraint to hold door open at 90 degrees position. Keyed handles for indoor panels are only acceptable where specifically approved. All NEMA 4X equipment enclosure doors to have three (3) point latching handle and locking hasp. NEMA 4X splice box enclosures shall have quick release latches. Plexiglas inner or outer doors are not acceptable.

- E. All PLC's, controllers, VFD's, instruments and electronic equipment installed outdoors or in unconditioned spaces shall have means of cooling to allow satisfactory operation in local environment and at conditions required by equipment manufacturer's specification. All motor starters over 100 horsepower shall have forced fan cooling in the starter section as a minimum. All outdoor enclosures are to have sufficient cooling. Provide rain hood, intake louvers, insect screens, and fan motor circuits with t-stat and on/off controls.
 - F. All control panels and motor control centers that are not standard manufacture, off the shelf products shall be manufactured in accordance with Plans and Specifications with high quality materials and components, bear a UL listed label, and be constructed by a UL listed shop.
- 2.01 Manufacturer shall have local manufacturing and/or repair facility within 200 miles and have local Service Technician that can provide prompt service when required by Owner. **Equipment Manufacturers who fabricate own panels may provide control panels for this project. Control panels will be fabricated accordingly to plans and Specifications. However, no outsourced panels are allowed except for Control Panel Manufacturers listed below. This requirement will be strictly enforced. No exceptions.** Service Technicians shall have detailed knowledge of control panels specific to this project. There are no exceptions to the requirements of this paragraph. The following Manufacturers are acceptable:
- 1. Weimar Manufacturing Co.
 - 2. B.L. Technology, Inc.
 - 3. W.W. Payton
 - 4. Ace Controls
 - 5. Texas Industrial Controls Manufacturing (TICM)
 - 6. Systems, Inc.
 - 7. Five Star Electric
 - 8. Control Panel Manufacturers listed in other Specification Sections.
- B. All pressure switches and transmitters on pump discharge lines are to have "snubbers" sized to produce hydraulic delay required for satisfactory operation of controls.

- C. Substitution items may be acceptable where deemed by Engineer to be of equal type, service, value, or suitable for a particular application. The Engineer reserves the right of decision on all substitutions unless specifications state, “no substitutions allowed”.
- D. Equipment ratings shown on plans are the “minimum” acceptable sizes. All Equipment Manufacturer’s products may not be available in the exact rating shown, in which case next greater available size shall be provided.
- E. Generator connectors installed at transfer switches shall be reverse service type with exposed female sleeve type and matching generator cable connector shall be recessed male pin type. Contractor shall coordinate connector’s style and size with Owner’s existing connectors to assure compatibility. Provide cut sheets or samples to Owner for confirmation. Provide adapters where needed for proper operation.
- F. All control panels and MCC’s shall have single piece door with door-mounted devices mounted directly to door. Plexiglas plates are not acceptable. Auxiliary mounting plates shall not be used to mount devices to door. All panels must be fabricated in a neat and professional manner. Metalwork shall be performed with proper commercially available tools, with no hacksaw or nibbler cuts allowed.
- G. All transmitter displays to be in actual unit values and not percent scale.
- H. All Motor Operated Valves (MOV’s) to have local control station with starter contacts, selector switches and limit switches, indicators and all other devices required to function as indicated on plans and in specifications. Where MOV’s are installed in pump discharge or suction line, provide interlock circuits that prevent motor operation when valve is closed.
- I. Door-mounted, rotating operating mechanisms for circuit breakers are not allowed for MCC’s or control panels.
- J. All components inside enclosures shall be fastened down with proper hardware. All cables shall be bundled and bound with waxed cord or nylon tie-wraps manufactured for that purpose. Adhesive tie down blocks are not allowed. Provide threaded press-in or welded studs for nylon cable clamps as required. All work shall be done in a neat and professional manner.

- K. All control panels, SCADA panels and MCC's shall have 120 VAC GFI duplex receptacles with low voltage circuit inside controls section for test equipment use. Control section shall have interior lighting. All gauges, instruments, transmitters, and meters to read 75% of scale at system maximum rated parameters such as voltage, amp, pressure, level, and flow.
- L. All controls circuits for PLC's, Multilins, RTU's, CCU's, CCTV, VFD's, solidstate starters, power monitors and all such products wired into a panel assembled by a panel fabricating shop or system integration shop shall be reviewed and approved by the Product Manufacturer's Representative. Contractor and Supplier shall allow for any additional cost associated with this review and approval process and shall certify such approval has been issued at time shop drawings are submitted.
- M. CT's for power monitor device, controller input or other instrument inputs shall be sized to detect peak inrush current motor.
- N. All electrical devices attached to or, normally a standard part of an equipment item shall be provided by that Equipment Manufacturer. For example, limit switches, solenoids, and transducers for flow control valves are to be provided by the Flow Control Valve Manufacturer. This is to be coordinated by the General Contractor and the Electrical Subcontractor.
- O. All equipment installed on this project shall incorporate all devices and features to protect that equipment from the influence of other equipment, line voltage and phase irregularities, power surges, harmonics and other disturbances that may effect the proper and safe operation of that equipment whether these required features are a standard component of that equipment as an off-the-line product. Provide surge protection devices (SPD) for all power feeders, service equipment and power panels. No equipment shall be installed without these features.
- P. All equipment installed shall include all DC power supplies operated from a 120-volt circuit. No equipment shall be battery powered only unless required by the specifications. Include all cabling and other components necessary for a complete operating system. Where firmware, software, or programming is required for operation satisfactory to Engineer, it shall be included accordingly.
- Q. All equipment and devices shall be NEMA rated. IEC rated equipment and devices are not acceptable.

- R. All requirements for instruments, motor operated valves, VFD's, and electrical equipment shown on electrical plans or described in electrical specifications shall be coordinated through the local Manufacturer's Representative to assure equipment meets the requirements for this project. All such items shall be purchased through local Distributors or sales offices located within 200 miles of this project. In any case, the local Factory Representative shall be consulted for exact requirements – no exceptions. This is to assure local service for Owner when needed on a 24-hour basis. Any items furnished that do not meet this requirement will be replaced at expense of Contractor.
- S. All MCC rooms with 800 amp devices and/or MCC's greater than 6 feet wide shall have doors at each end of room unless NEC exceptions apply. Doors shall open in direction of egress and shall have panic bars per NEC Article 110.
- T. All electrical work shall be performed in a neat and orderly manner. Any work that does not appear as professional workmanship shall be corrected or replaced, at Engineers discretion.
- U. All slabs around electrical equipment shall be constructed and sloped to avoid any standing water.
- V. Where equipment model numbers are shown on plans or specifications, provide most current model or version.
- W. Where devices with RS-485 outputs are installed, provide an RS-485 to Ethernet converter with associated power supply.
- X. For rehab or expansion work on controls, provide additional new panduit wireways. Do not overfill Panduit on new or rehab projects.
- Y. All electronic controllers, instruments, and devices furnished by any Vendor or Manufacturer shall have an ethernet data port and means for status monitoring and control interface with the plant PLC controller. Vendor to provide all programs, software, and I/O addresses.
- Z. All service and feeder breakers to be electronic type with adjustable trips.
- AA. All analog instrument outputs to be 4-20 mA unless noted otherwise on Plans. Coordinate scaling with Engineer.

- BB. Provide complete power, control and instrumentation circuits for motor breakers, RTDs, temperature sensors, instruments and control devices.
- CC. All well and blower motor starters to have start time delay relay.
- DD. All equipment, instruments and devices provided for this project shall have means of protection from power line conditions such as surge, phase fail, or other line conditions that may damage equipment, instruments or devices furnished. It is vendors and manufacturers' responsibility to provide protective devices as required for maintaining warranty of furnished items and to assure no damage occurs from power line conditions.

2.02 PLANS AND SPECIFICATIONS

- A. Electrical plans and specifications are not intended to discriminate against any particular manufacturer. Specific values shown for a particular manufacturer's product may vary slightly for another product.
- B. Work required under this contract consists of each and every item, equipment, material and device shown on any of the Civil, Structural, Mechanical, Process, Electrical or other plan sheets contained in the contract documents and includes items shown in details, schedules, diagrams, sections or other means of illustration presented. If any item is shown on a single sheet at any place, it is to be included under this contract unless specifically noted otherwise and, all piping, wiring, and connections for operation of the item shall be included at no additional cost to Owner. If there is any doubt or question, Contractor shall request a "clarification" from Engineer before bidding. The Electrical Engineer reserves the right to interpret the electrical specifications and to make judgment as to acceptance of a product, regardless of minute details in the specifications or on the plans.
- C. Specifications shall be reviewed for applicability of materials under certain conditions and in certain environments and, where not shown otherwise on plan drawings, these application directions shall be adhered to.
- D. Where a particular reference on drawing plans does not conform to standard acceptable construction methods for a particular type project, the Contractor shall immediately notify the Engineer and request a clarification before ordering materials or starting construction.

- E. Plans are general in nature and may not show minute details of existing conditions or proposed work. Existing conditions may include undocumented buried pipes, conduits and structures that lie in the route, or at location, of equipment or conduit installation required for this project. These uncertainties shall be accounted for in the Contractors Bid. Contractor shall adjust conduit routes, equipment pads, and equipment mountings, as required, for a satisfactory installation for the conditions imposed and at no additional cost to the Owner.
- F. Electrical site plan drawings shall only be scaled when "Scalable Drawing" appears on the drawing sheets.
- G. All electrical equipment, controls, and devices used in this project shall have self-protection features that prevent damage of that equipment from overload, overvoltage, undervoltage and phase fail conditions. Any failures caused by lack of this provision shall be at full cost to Contractor and equipment manufacturer and at no additional cost to Owner. Where Engineer determines this to be the case and where Contractor disagrees, Contractor shall provide full evidence of failure cause at their own expense.

PART 3 EXECUTION

3.00 WORKMANSHIP

- A. All wiring shall be installed in accordance with current NEC and local codes. Field select routing of conduits to avoid underground piping, conduit or structures that may not be shown on plans.
- B. All construction and equipment fabrication shall be of highest quality and installed in a professional manner. All devices shall be manufactured specifically for the purpose installed and shall be installed according to Manufacturer's recommendations.
- C. All fixtures, switch, and receptacle locations shall be approved by Engineer.
- D. Refer to other sections of this specification for controls. Under this section of the specifications, the Contractor shall install the control devices and provide control wiring switches, outlet boxes, and shall make all final connections. Control wiring and interlocks shall conform to wiring diagrams furnished by equipment manufacturers.
- E. Coordinate location of motor terminal box to match location of conduit stub up, drop or connection on same side of motor.

- F. Where equipment, devices, or installation fails or is damaged during construction, said equipment and/or devices shall be replaced with new unit. Repair is not an acceptable remedy unless specifically approved by Engineer and/or Owner.
- G. Provide 48 inches minimum workspace in front of electrical equipment.
- H. Provide a minimum of 8 inches between all wall or rack mounted enclosure boxes, switches, or equipment. Do not extend past edge of building wall and maintain 6 inches from edge of wall.

3.01 ELECTRICAL SYSTEM ACCEPTANCE

- A. System acceptance upon Substantial Completion shall be defined as that point in time when the following requirements have been fulfilled:
 - 1. When Record drawings and wiring diagrams have been submitted, reviewed, and approved in writing by Engineer.
 - 2. All O&M documentation has been submitted, reviewed, and approved.
 - 3. The complete electrical system has been fully inspected and has successfully been started up, tested and accepted by the Engineer.
 - a. Complete electrical system shall be demonstrated to be fully functional. Every alarm function shall be exercised.
 - b. Complete electrical system shall run continuously for a period of ninety (90) consecutive days without failure. In event of failure, repairs shall be made and test period started over again.
 - c. There are no “Substantial Completions” for electrical systems that cannot demonstrate satisfactory performance of its intended function.
 - 4. All Owners’ staff personnel training programs have been completed.
 - 5. Owner/Engineer sign a document indicating electrical installation has formally been accepted.
 - 6. Warranty certificates for electrical equipment have been properly submitted.
 - 7. All spare parts have been delivered to Owner.

8. All punch list items have been corrected, acknowledged by Contractor in writing and accepted by Engineer.
9. Contractor shall have equipment vendors available for installation, setup, testing, demonstration and commissioning activities as required by other specifications section. Vendors shall allow ample time for these on-site services in their bids.

3.02 CLEAN UP

- A. The Contractor shall upon completion of the work, remove all materials, empty containers, and any other materials that are not incorporated into the work.
- B. Concrete spoils shall not be dumped on site without approval by Engineer or Owner.

3.03 WARRANTY

- A. Contractor shall provide full 3-year service warranty on the overall installation, and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin at date of written final acceptance of electrical systems and shall include both labor and materials at no additional cost to owner. There are no exceptions to this requirement. Contractor's warranty shall guarantee 24-hour service response time and shall provide whatever labor, work, or materials needed to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for over 24 hours from time Owner calls for warranty service. This shall be at no additional cost to Owner.
- B. Where circuit problems such as irregular power conditions, breaker trips, relay trips, controls failure, etc. develop during construction or prior to or within the 1 year warranty period, Contractor shall furnish a multi-channel recording device with all appurtenances for a total period of 60 days per event and, shall include setup and data retrieval. Work shall be performed when requested by Engineer and shall be at no additional cost to Owner. These conditions also apply to electrical problems during construction where operations of the plant are affected.
- C. All materials and equipment installed shall have full warranty from manufacturer that guarantees equipment is rated for the harsh Industrial Electrical/Mechanical environment in which it is installed. Where manufacturer's products fail prematurely, manufacturer shall be fully responsible for new replacement and shall not have option of declaring that failures were caused by environment and its affect on the product.

Contractor is fully responsible for assuring that product manufacturers are aware of this condition and that manufacturer's warranty statement is included in shop drawings. Failure to do so will be at full expense of Contractor and at no additional cost to Owner. Where warranty requirements are shown in other sections, the more stringent requirement shall have precedence.

- D. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within five (5) working days from date of notice are subject to Owner making other arrangements for repair and backcharging Contractor. This requirement is a condition of this contract.
- E. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

3.04 TRAINING

- A. The Contractor shall provide services of his Technician and a factory trained Technician to instruct plant-operating personnel for a period of at least two (2) full days after completion of the contract work. Training requirements in specific specification sections shall have precedence over requirements of this section.
- B. Where training is required by any specification sections, Contractor shall provide training manuals for Operators. Manuals shall be approved as substantial quality by Engineer. All training manuals must be pre-approved by Engineer. Instructors shall be pre-approved by Engineer as qualified for training. Provide a training manual for each Trainee attending class. Training manuals and approved O&M Manuals shall be used during training.
- C. Provide Engineer with an outline of training course and topics to be covered.
- D. Schedule with Owner two (2) weeks in advance. Where Operators must alternate training schedule, more than two (2) days may be required.
- E. Operations and Maintenance (O&M) manuals and "Record" drawings shall be used during training.
- F. Engineer may participate in training.

3.05 TESTING AND STARTUP

- A. All elements of each electrical control system shall be set up, calibrated, and tested by Manufacturer's Technician to demonstrate that the total system satisfies all of the requirements of this Specification. All special testing of materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner and Systems Integration Engineer. As a minimum, the testing shall include both a factory test and a field test. Testing requirements are as follows:
1. Factory Tests: The electrical controls, motor control centers, switchgear, SCADA, instrumentation systems, and all other associated hardware shall be tested via a full simulation at the factory, prior to shipment, to demonstrate that each component is operational and meets the requirements of these specifications. Manufacturer shall provide test routine program for shop simulation of I/O signals where test are unavailable in shop.
- B. Where solid-state controller programs are furnished by a specified Systems Integration Programmer, a copy of the program shall be provided on CD for Manufacturer's use in factory testing. Test results shall be certified, with written documentation provided to the Engineer upon test completion. Factory testing of controls shall be witnessed by the Engineer and/or Programmer for all control systems containing a solidstate controller of any type. Control System Fabricator shall notify project Electrical Engineer a minimum of (6) six weeks in advance of shop testing, and shall confirm equipment will be ready for testing when arrival of Programmer and/or Engineer. Prior to time of testing or during testing, a Program shall be downloaded to the controller by the Programmer or Engineer.
- C. Where testing facility is located, more than 100 miles from job site and where testing period goes past 6 p.m., Supplier shall provide suitable accommodations for overnight stay for Engineer and Programmer at cost of Supplier.
- D. Field Tests: All electrical control system components and instruments shall be checked to verify that they have been installed properly, all terminations have been made correctly and signal parameters are accurate. This includes demonstration of accuracy or all instruments over entire range of operation by live simulation of measurement. Electronic simulation above is not acceptable.

- E. Witnessed field tests shall be performed on the complete system. Prior to witnessed test, Contractor shall perform a complete test of each and every function, device operation and overall operations of electrical power, control, instrumentation and SCADA system.
- F. Prior to loading PLC or SCADA final program and prior to testing operation any PLC or SCADA set up by programmer, an inspection shall be conducted by Engineer's Inspector to assure electrical control devices are functioning properly. Any discrepancies or problems shall be corrected and then Contractor shall send a written notice that complete electrical control system is installed and operating per the Plans and Specifications.
- G. Contractor shall provide a checklist for all electrical, control and instrumentation functions and send to Engineer for approval. Each function shall be demonstrated to the satisfaction of the Owner and Engineer on a paragraph-by-paragraph basis. Any equipment, devices or functions that are found not performing properly will be reason for termination of test until repairs are made. Additional testing by Engineer and Owner may be at Contractor's expense for time and travel of Engineer and Owner's staff. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion. The equipment Manufacturer's Representative shall be present for all testing, setup, demonstrations, and training. The Contractor shall notify the Owner at least two (2) weeks prior to the commencement date of the field tests. After tests are completed and with system fully operational, system shall run continuously for a period of 90 days without failure. Any failures shall be repaired and test shall start over again.
 - 1. Additional Requirements:
 - a. Measure and record all motor in-rush, run current and terminal voltage at start and run testing. Where multiple motors are installed, test shall include all motor sequencing smallest to largest. Submit recorded values for Engineer's review. Provide instrument and electronic devices calibration ranges and scales for this specific project. (Manufacturer's general information is not sufficient. Include range of 4-20 mA signals, i.e., 4 mA = X psi or Y feet, etc. for each specific instrument and device.)
 - b. Provide setting and adjustments of all solid-state and non-solid-state starters, circuit breakers, controllers, instruments, and other equipment with adjustable settings both manual and programmable. Submit for Engineer's review and approval before operating equipment.

- H. Provide statement of satisfactory demonstration of all instruments, devices and equipment functions over full range of operation. (Any failures or incorrect calibrations or settings detected shall be reason to halt demonstration tests and reschedule after adjustments and recalibrations have been completed.)
- I. Factory Technician report stating that all calibrations, settings and adjustments have been completed and that equipment has been functionally tested by Factory Technician on site. (Where report is found to be inaccurate, the Technician shall make necessary on site adjustments and shall issue new report, and where second report is required, a Factory Manager shall sign report attesting to its accuracy. There is no exception to this requirement. Contractor shall be responsible for all factory set up, testing and demonstration costs until system is accepted by the Engineer. Any additional testing as result of non-acceptance by Engineer shall be at Contractor's expense.
- J. Record Drawings (Point to point wiring diagrams for every electrical device installed on this project with tags and applicable schedules shall be available at time of testing. Lack of this requirement will result in cancellation of testing until complete documentation is available. This will allow checking of wiring accuracy at time of testing.)
- K. A state licensed Electrician shall be present at all scheduled inspections.
- L. Controller Program: Remote testing by Engineer will require a minimum of 30 working days after programs are downloaded to the controller. Provide six (6) weeks' notice for program downloading by Programmer. This shall be accounted for in project schedule. Any delay of project completion due to lack of notice is at Contractor's risk and expense.
- M. Prior to testing system, PLC programs or HMI programs provided by other than the Systems Integration Engineer noted in Item 1.07 – "Contractor's Responsibilities", programs shall be furnished on CD for review by Engineer. Provide any special software necessary to run and test complete program.

END OF SECTION

SECTION 16013
ELECTRICAL SUBMITTALS

PART 1 GENERAL

1.00 GENERAL REQUIREMENTS

- A. Requirements described by this section are in addition to any requirements of the General Conditions of the project. The electrical engineer requires electronic submittals for all equipment provided under the electrical and controls specifications. Do not submit hardcopies to the electrical engineer. This does not eliminate any requirements for hardcopies required by the Owner as required by the General Conditions.
- B. Requirements of this section apply to all other electrical instrumentation and control related specifications for this project. Submittals provided without all required information are subject to be rejected without review.
- C. Contractor is to provide a schedule that at minimum shows estimated start dates, completion dates, shop test dates, and field test dates. It is the contractor's responsibility to provide updated schedules to our office in a timely manner.
- D. Contractor is required to provide the electrical submittal log with electrical or controls submittals.
- E. Contractor is fully responsible for coordinating/submitting correct operating voltage, horsepower, current, phase and starter sizes requirements of all equipment furnished and installed under this contract. Shop drawing review by Engineer does not remove this responsibility. Manufacturer's light fixture and accessories data sheets shall not confirm reference to "Contractor Select". Data sheets shall have model numbers that correctly identifies fixture and accessories as described and included on plans and in specifications. Incorrect submittal information is at risk of Contractor and at no additional cost to Owner.
- F. Submittals of motor control and electronic device shop drawings will require a minimum of two (2) weeks for review from time of receipt by Electrical Engineer. Contractor shall submit all shop drawings in time to account for this period of review.

- G. All submittals for motor control centers, control panels, control sections, controllers, lift pump panels, and Vendor furnished panels must contain statement of U.L. certification and identifying name and number of U.L. certification for fabricating shop.

All submittals without this information will be rejected. Any MCC's or panels installed without U.L. listing and where not acceptable by Engineer or Owner will be replaced at cost of Contractor.

- H. Where submittals for a particular equipment, device or material item vary from that specified or shown on plan drawings, and where that item is not specifically noted as acceptable and, where installation of submitted item results in improper or undesirable operation of the system, Contractor shall be liable for removal and/or replacement of that item with the item specified or shown on plan drawings at no additional cost to Owner. Such items submitted as substitutions shall be listed separately and clearly noted as "Substituted Item". Do not include Manufacturer's catalog data pages that do not apply to specific equipment or devices used for this project.
- I. General Contractor shall route all Vendor submittals with electrical requirements to Electrical Contractor who shall review and coordinate all power and control requirements and affix stamp certifying coordination. Any variation to plans or specifications shall be noted accordingly on Vendor's submittal.
- J. All equipment shop drawings shall indicate changes or modifications as a result of previous submittal variances. No shop drawings shall be submitted that have not been coordinated as required by this specification. Any submittals not coordinated as such will be at Contractor's risk and at no additional cost to Owner for required changes necessary for a complete operating system as intended by the plans and specifications for this project.
- K. Provide detailed drawings of equipment, MCC's, transformers, and control panel layout in room or on area plan drawing. Show dimensions of device layouts on control panels. Show room or area dimensions, conduit stub-up locations, and all other dimensions relative to placement of equipment. All equipment shall fit available space shown on plans. Provide detailed drawings of any modifications, concrete cutting or breaking, or any work not shown on drawings for Engineer's approval. Non-submittal of any such work will result in corrective action at Contractor's expense. Special fabrication may be required for MCC's, control panels and other equipment.

Note any exceptions or variations in size, location or configuration on submittal. Do not order equipment, MCC's, or panels until submittal has been approved by Engineer in writing. Where outdoor light poles and pull boxes are installed, provide dimensioned location layout submittal before starting work.

- L. Provide detailed sketch of all unistrut racks and other type mounting assemblies for Engineer's review before starting work. Items not submitted and not determined as acceptable after construction shall be replaced at no additional cost to Owner.
- M. Any notifications or changes to contract plans and specifications shall be authorized by Engineer before submitting shop drawings for approval.
- N. With each submittal, include an electronic copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.01 SUBMITTAL REQUIRMENTS

- A. Contractor is to submit all shop drawings, and product data required per the relevant specifications section at one time. All related submittals are to be submitted at one time.
- B. Contractor to follow a consistent naming convention such as:
 - 1. Submittal Number – Submittal Name – Revision Number.File Extension
 - a. ##-Submittal Title-Rev #.PDF
- C. Submittals are to be formatted as a single PDF format with a table of contents. Submittals that are provided as a group of PDF files not formatted as described will be rejected.
- D. The following information must be provided with each submittal:
 - 1. Date and Revisions Dates
 - 2. Project Title matching plans and specifications
 - 3. Prime Engineer's Project Number
 - 4. Electrical Engineer's Project Number

5. Name of Project Manager, Address and Telephone Numbers of:
 - a. General Contractor
 - b. Electrical Contractor
 - c. Vendor
 - d. Manufacturer
6. Specification Section Number
7. Submittal Log
8. List of Deviations and Reasons
9. Specifications Compliance Checklist
10. General Contractor Signature

1.02 SUBMITTAL LOG

Item No.	Submittal Description	Related Electrical Specification Sections	Submitted
1.	Construction Schedule	16012	
2.	Well Pump and Motor	16150	
3.	Booster Pumps	16150	
4.	Automatic Transfer Switch	16496	
5.	Manual Transfer Switch	16494	
6.	Generator	N/A	
7.	Autosensory Panel	16012, 16016, 16195, 16904, 16935, 16936, 16950	

8.	Motor Control Center	16176, 16290, 16410, 16452, 16460, 16470, 16481, 16482, 16484, 16496, 16911, 16662	
9.	Site, Control Room and Generator Pad Layouts	N/A	
10.	Electrical Service Equipment	16401	
11.	Misc. Electrical Equipment <i>(Include conduit, conductors, lighting, HVAC, transformers, panelboards, disconnects, grounding, and other appurtenances)</i>	16012, 16111, 16120, 16125, 16126, 16402, 16452, 16460, 16470, 16476, ,16510, 16515, 16525, as indicated on electrical plans	
12.	Chemical Feed Equipment	N/A	
13.	Flow Meter(s)	N/A	
14.	Flow Control Valve(s)	N/A	
15.	O&M Manuals	16012	
16.	Record Drawings	16012 & 16014	

Notes:

1. Submittal log to be included with each submittal. Check off all submittals previously submitted in the far right column.
2. Submittals may be combined.

END OF SECTION

SECTION 16014

ELECTRICAL OPERATION & MAINTENANCE (O&M) MANUAL

PART 1 GENERAL

1.00 GENERAL REQUIREMENTS

- A. Requirements described by this section are in addition to any requirements of the General Conditions of the project. The electrical engineer requires electronic submittals for all equipment provided under the electrical and controls specifications. Do not submit hardcopies to the Electrical Engineer. This does not eliminate any requirements for hardcopies required by the Owner as required by the General Conditions.
- B. Any hardcopies provided to Owner after approval by Electrical Engineer are to be professionally assembled with tabs and coversheets.
 - 1. Wiring diagrams shall be on same size pages (8.5x11 or 11x17 pullout sheets) as used in Operations and Maintenance Manuals and shall be placed in a separate section of the Manuals identified as Wiring Diagrams.
 - 2. Each O&M Manual hard copy shall include a CD that contains the complete, organized O&M Manual in PDF format inserted in a pocket near front of Manual. All O&M Manuals shall be professionally written and bound in high quality latching post vinyl binder. Loose page three ring binders are not allowed.
- C. Requirements of this section apply to all other electrical instrumentation and control related specifications for this project. Submittals provided without all required information are subject to be rejected without review.
- D. Provide diagrams of all controls panels and MCC's in clear plastic laminated pages. One (1) copy in ring binder for Operator and one (1) copy in pocket affixed to inside of cabinet door.
- E. Contractor is to provide submittals in accordance with 16013 Electrical Submittals

1.01 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. Contractor is to submit all shop drawings, and product data required per the relevant specifications section at one time. All related submittals are to be submitted at one time.

1. The contents of the O&M manuals shall be generally organized as follows:
2. Contact Information for all contractors and vendors
3. System Hardware/Installation
4. System Software (where applicable)
5. Operation (step-by-step procedures)
6. Electrical and Control Wiring Diagrams
7. Maintenance and Troubleshooting
8. Warranty Certificates
9. Point-to-Point Wiring Diagrams for each circuit installed or provided by equipment suppliers.
10. Device Information
 - a. Instrument and electronic devices calibration ranges and scales for this specific project. (Manufacturer's general information is not sufficient. Include range of 4-20 mA signals, i.e., 4 mA = X psi or Y feet, etc. for each specific instrument and device.)
 - b. Setting and adjustments of all solid-state and non-solid-state starters, SCADA, PLC's, circuit breakers, controllers, instruments, and other equipment and devices with adjustable settings both manual and programmable settings. Provide this information in table format and show current settings of each adjustable device for this installation, in each motor control center section and each control panel.
 - c. Statement of satisfactory demonstration of all instruments, devices and equipment functions over full range of operation. (Any failures or incorrect calibrations or settings detected shall be reason to halt demonstration tests and reschedule after adjustments and recalibrations have been completed.)

- d. Factory Technician report stating that all calibrations, settings and adjustments have been completed and that equipment has been functionally tested by Factory Technician on site. Where report is found to be inaccurate, the Technician shall make necessary on site adjustments and shall issue new report, and where second report is required, a Factory Manager shall sign report attesting to its accuracy. There is no exception to this requirement. Contractor shall be responsible for all factory set up, testing and demonstration costs until system is accepted by the Design Engineer. Any additional testing as result of non-acceptance by Engineer shall be at Contractor's expense.

1.02 RECORD DRAWINGS

- A. The Contractor is required to keep up to date redlines at all times and may be reviewed during construction at any time by the Engineer. Record Drawings that are found to be inaccurate are the responsibility of the Contractor.
- B. Record Drawing Drawings to include point-to-point wiring diagrams for every electrical device installed on this project.
- C. Provide Record Drawing that clearly show any work that varies from the Contract Drawings. Remove any lines or text from drawings that no longer apply as a result of as-installed variations. "Record Drawing" Drawings shall be on backgrounds that are furnished by the Engineer. All changes are to be in latest version of AutoCAD or other applicable CAD methods as required by Owner or Engineer. Contact Engineer for CAD standards to be followed. Submit Record Drawing Drawings electronically for review.
- D. All underground conduits entering any building under or in slab shall be accurately dimensioned as to location. Show accurate dimensioned layout of conduits under or encased in building slabs. Record Drawing mark-ups shall be submitted to Engineer for review and coordination prior to cover up with slab or backfill.
- E. Show accurate dimensioned location of all conduits and ductbanks on site and on structures that are installed or modified under this contract. Identify conduits by tag number.
- F. Show location and identify all new or relocated devices and equipment in rooms and on structures.

- G. Provide accurate and complete point-to-point wiring diagrams for all power, control and instrument circuits. Identify each conductor, conduit, terminal block, and device terminal. Use manufactures device terminal numbers and do not assign new conflicting termination numbers. Quality and content of diagrams and drawings shall be such that future troubleshooting or modifications may be done without additional information from field observations. Contractor will be asked to demonstrate certain circuits selected by Engineer or Owner to assure accuracy and completeness of diagrams. Any errors shall be corrected before acceptance of work. This work includes every circuit installed or modified under this contract, without exception.

- H. Record Drawing construction drawings shall be provided on full size plan sheets for Owner and furnished electronically in Autocad format for Owner and Electrical Engineers files. Provide hard copy quantities specified in this specification or in General Conditions Specifications, whichever is more stringent.

END OF SECTION

SECTION 16016
CONTROL PANELS

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to other electrical specification sections for additional requirements.
- C. The purpose of this specification section is to assure quality construction and fabrication of control panels for this project. Any Manufacturer that cannot meet the requirements of this specification section will not be considered.
- D. This specification section applies to both individual control panels and control sections of motor control centers.
- E. All equipment and devices shall be NEMA rated. IEC rated equipment and devices are not acceptable.
- F. Only control panels fabricated by shops listed in Section 16012 – “Electrical Work,” Item 2.01 – “Materials” are acceptable. No exceptions, unless control panel is off-the-shelf product provided as part of process equipment installation and is manufactured by the Equipment Supplier, or where control panel is specified as part of equipment specified by Engineer of Record in other Specification Sections.
- G. Refer to Specification Section 16949 – “Cellular Router” for additional requirements.
- H. All software or programs provided by any Vendor or Contractor shall be open activation without undisclosed passwords, keys, and/or means or devices that prevent Owners access to programs. All software shall be new copies for Owner with no cost attachments. No exceptions.
- I. All PLC’s and/or solidstate controllers installed in any Vendor furnished control panels or starters shall have ModBus TCP Communications Protocol and shall have Ethernet port available for connection to SCADA system fiber optic or network. Equipment Vendors shall provide programming for their PLC’s such that pertinent control, alarm, and status data is available for use by SCADA system.

This does not include SSC programming as described in Item 1.00 – “Conditions” of this specification section. General Contractor shall be fully responsible for coordinating this requirement.

- J. Programmable Logic Controller (PLC) and Human Machine Interface (HMI) hardware, HMI templates, address, tags, and software are to be provided by Vendors and Contractor. All drivers and related software purchased by Contractor shall be compatible versions to allow satisfactory interface of all equipment, solid-state controllers and systems. Contractor shall have statement from Vendors that all drivers are proper type for this application. Timely submittal of data for Programmers use is critical and Contractor is solely responsible for delivery to Programmer who is not responsible for results of late delivery.

1.01 SECTION INCLUDES

- A. Control switches, relays, transformers, alarm panels, terminal blocks, power suppliers, and accessories
- B. Panel fabrication and assembly requirements.

1.02 REFERENCES

- A. NEMA ICS 1 - General Standards for Industrial Control and Systems.
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA ICS 3 - Industrial Systems.
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- E. NEMA ST 1 - Standard for Specialty Transformers (Except General Purpose Type).
- F. ISA - Instrument Society of America.
- G. UL - Underwriter Laboratories.
- H. FM - Factory Mutual.
- I. IEEE - Institute of Electrical and Electronic Engineers.
- J. NFPA - National Fire Protection Association.
- K. NEC - National Electrical Code.

- L. JIC - Joint Industrial Council.
- M. ANSI - American National Standards Institute.

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval.
- B. Submit shop drawings indicating layout of completed assemblies, interconnecting cabling, dimensions, weights, and external power requirements. Show available space and proposed equipment dimensions. Provide special fabrication where required to fit available space.
- C. Submit product data for each component specified and/or included in control panel.
- D. Submit manufacturer's certificate that all equipment meet or exceed specified requirements.
- E. Submit manufacturer's proof of certification by U.L. for construction of U.L. listed control systems.
- F. Submit manufacturer's installation instructions.
- G. See specification sections listed under Item 1.00 – "Conditions" for additional requirements.
- H. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph.
- I. Identify applicable drawing sheet number and specification section on front of each submittal cover.
- J. Provide CAD files of all diagrams, equipment views, and material and device schedules on CD and include with submittals. Only one (1) CD required for Electrical Engineer. See submittal requirements in Item 1.05 – "Operation and Maintenance (O&M) Data."

1.04 PROJECT RECORD DOCUMENTS

- A. Submit record documents reflecting actual construction. Refer to Item 1.10 – "Record Drawings and Documentation" for additional requirements.

- B. Accurately record actual locations of control cabinets and input and output devices connected to system. Include interconnection wiring and cabling information and terminal block layouts in control cabinets, inserted in an aluminum drawing pocket on inside of door.
- C. During drawing submittal phase, submit detailed information consisting of ladder logic and line code, complete input, output, relay and controls identification labels and written description of program operation. Ladder logic diagrams submitted shall contain a written descriptive note for each line, describing the function and logic of that line. Submit all documents in hard copy and on CD.
- D. Submit factory-testing procedures proposed to verify all input, output, loop operation, and system logic verification. Testing procedures submitted shall detail, as a minimum, verification of the following required minimum functions:
 - E. Verify motor start, motor stop, and level or pressure alarm outputs by simulating signals representing levels or pressures.
 - F. Verification of each discrete input via external manually operated connection.
 - G. The system shall be tested and verified with all external devices required to simulate field connections connected simultaneously for a full system test.
 - H. Shop Drawings shall be submitted in complete packages grouped to permit review of related items as generally outlined in these specifications.
 - I. All Shop Drawings shall be bound in three ring binders with complete indexing and tab dividers. All equipment information shall be completely tagged and labeled to correspond with the drawings.
 - J. Review of Shop Drawings shall be for conformance with Contract Documents and with regard to functions specified to be provided.
 - K. Panels, Consoles, and Cabinets Information:
 - 1. Layout Drawings include the following:
 - a. Front, rear, end, and plan views to scale.
 - b. Dimensional information.

- c. Tag number and functional name of components mounted in and on panel, console, or cabinet.
 - d. Product information on all panel components.
 - e. Nameplate location and legend including text, letter size, and colors to be used.
 - f. Location of anchoring connections and holes.
 - g. Location of external wiring and/or piping connections.
 - h. Mounting and installation details.
 - i. Proposed layouts and sizes of graphic display panels.
2. Wiring and/or piping diagrams include the following:
 - a. Name of panel, console, or cabinet.
 - b. Wiring sizes and types.
 - c. Piping and tubing sizes and types.
 - d. Terminal strip numbers.
 - e. Color coding.
 - f. Functional name and manufacturer's designation for components to which wiring and piping are connected.
 3. Electrical control schematics in accordance with JIC standards.
 4. Plan showing equipment layout in each area.
- L. Field wiring and piping/tubing diagrams, include the following:
1. Wiring and piping/tubing sizes and types.
 2. Terminal strip numbers.
 3. Color coding.

4. Conduits in which wiring is to be located.
5. Location, functional name and manufacturer's designation of items to which wiring and/or piping are connected.
6. Point-to-point wiring diagrams.

1.05 OPERATION AND MAINTENANCE (O&M) DATA

- A. Submit operation and maintenance data for Engineers approval.
- B. Include bound copies of operating and programming instructions.
- C. Include component replacement, adjustments, and preventative maintenance procedures and materials.
- D. Furnish six (6) copies of O&M manuals for the Control System in accordance with the requirements of Specification Section 16012 – “Electrical Work,” Item 1.05 – “Operation and Maintenance (O&M) Manuals.” Provide one (1) CD with complete O&M manual for Electrical Engineer’s use.
- E. Provide diagrams of all controls panels and MCC’s in clear plastic laminated pages. One (1) copy in ring binder for Operator and one (1) copy in pocket affixed to inside of cabinet door.
- F. Submit O&M manuals prior to the time the control system equipment is delivered to the site.
- G. O&M manuals shall be submitted in hard-back three-ring loose-leaf binders with a complete table of contents and drawing indexes for each binder and dividers for each section. Binders shall have clear plastic pocket on the back side. Enclose in the pocket a computer printed label including facility name, address and job number. Stick on labels shall not be used. Information shall be professionally written and assembled - a simple collection of cut sheets is not acceptable.
- H. The O&M manuals shall include the following as a minimum:
 1. Name, address, and telephone number of the control system supplier's local service representative.

2. Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided. Specific, not general, data is required.
3. Copy of all approved submittal information and system shop drawings as specified in Part 1.04 above with corrections made to reflect actual system as tested and delivered to the site for installation. Half-size black line reproductions shall be provided for all shop drawings larger than 11x17 inches.
4. Provide a set of O&M manuals including, red line control, and electrical schematics for substantial completion inspection at the facility site.
5. Provide and include in the O&M manual, control system description, and system operation sequence instructions. This shall be concise and professionally written.
6. Control and loop diagrams, electrical drawings, and system description and operation instructions shall be submitted in a separate binder.
7. Provide individual sets of O&M manuals for each station when project includes group of stations.
8. O&M Manuals shall professionally written and not be an assembly of Manufacturer's cut sheets.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the assembled control products specified in this specification section with minimum 3 years documented experience, which maintains service facilities within 200 miles of project, and with proven compatibility with Owner's existing type facilities.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in acceptable condition and in protective wrappings.
- B. Store and protect products from damage.
- C. Accept products on site in factory containers and verify damage.
- D. Store products in clean, dry area; maintain temperature to NEMA ICS 1.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature above 32°F and below 104°F during and after installation of products.
- B. Maintain area free of dirt and dust during and after installation of products.
- C. Provide temporary heating and air conditioning units and equipment required to maintain environmental conditions specified for control and MCC panels.

1.09 MAINTENANCE SERVICE

- A. Provide manufacturer's Maintenance Services of control systems for one year from Date of Substantial Completion.

1.10 RECORD DRAWINGS AND DOCUMENTATION

- A. The Contractor and control systems supplier shall revise system shop drawings, submittals and documentation to reflect as-built conditions in accordance with the requirements of the supplemental requirements below.
- B. Six copies of all revised shop drawings and documentation shall be submitted to the Engineer for approval to replace out-dated drawings and documentation contained in the System O&M Manuals. Half-size black line sets shall be provided for all drawings larger than 11x17. Specific instructions for out-dated drawing removal and replacement shall be provided with the record drawing submittal.
- C. Half-size black line prints of wiring diagrams applicable to each control panel shall be placed inside a clear plastic envelope and stored in a suitable print pocket or container inside each control panel.
- D. Six copies of the following reports shall be submitted to the Engineer:
- E. Factory Test Reports if specified.
- F. Installation Inspection, Field Calibration, and Field Testing Reports.
- G. All updated record drawings shall be delivered to Engineer for approval prior to final acceptance of construction work.

PART 2 PANEL CONSTRUCTION AND PRODUCTS

2.00 PANEL CONSTRUCTION

A. Wiring Methods:

1. All interconnect wiring inside panel to be stranded copper conductors intended for panel wire use. Thermoplastic covered wire is not to be used.
2. All wiring to be bundled and laced with wax cord or nylon cable ties or, may be installed in panduit wireways.
3. Cable ties shall be spaced at intervals not to exceed 4 inches. All wiring between device terminals and wireways shall be orderly and tied. Wire markers shall be visible without removing wiring from a wireway.
4. Where wireways are used, they shall be properly sized for wiring contained within and shall not be oversized. Wireway fill shall not exceed 75 percent of wireway capacity and shall not be less than 25 percent of wireway capacity. Wireway width to depth ratio shall not be less than 2 to 1.
5. All cable ties shall be trimmed and loose ends shall not exceed 1/8 inch in length after trimming.
6. Wiring bundles shall be secured in place with nylon cable clamps that are attached to the mounting plate with stainless steel bolts. Cable bundles attached to the back side of a front plate or cover plate shall be via steel studs welded to the plate before painting. Counter sunk head steel bolts may be used in which case the head finish shall match the panel finish in color so as to provide a neat appearance of the front panel. Adhesive type cable tie restraints are not allowed.
7. Wire splices inside panels are prohibited. Wire nuts and similar devices are prohibited. Split, bridged, or extended circuits shall be done via use of terminal strips only except where looped grounds or power circuits may be used where wire is not cut and is attached at each device with proper terminal devices. All circuits shall be continuous and unbroken.
8. Use wire strippers of proper size to avoid wire nicks or cut strands. Trimming strands to make wire fit a terminal is prohibited. Provide proper sized wire and/or terminal device.

B. Device Mounting:

1. All devices mounted on plates or doors shall be installed in holes that are punched with dies that specifically match the device requirements. Holes may be formed with machine tools. No mounting holes are to be cut with saws, nibblers, or similar tools not made for professional panel fabrication. All edges to be smooth and free of burrs.
2. Panels that have scratches or are otherwise damaged when mounting devices may be touched up with the same identical paint where dried under the same conditions of heat or drying as the original panel finish. Repairs shall not be detectable.
3. All panels to be constructed of 316 stainless steel, 16 gauge painted steel, or 16 gauge aluminum, as noted on plans. All doors to be constructed so as to prevent flexing or twisting movement when opened. This is especially of concern when devices are mounted on door. Lightweight doors are not acceptable. Inner panel is to be aluminum or steel. Plexiglas panel is not acceptable.
4. Where panel is provided by an Equipment Manufacturer as part of the specified equipment package, the Equipment Manufacturer shall be held to these same standards and requirements. Providing panels of less quality than these standards will not be acceptable regardless of Equipment Manufacturer's standard panel specification described in equipment data sheets. Other specification sections of lesser quality do not supercede the requirements of this specification section.
5. No devices shall be mounted in outer door of panels except where specifically noted on plans.
6. Where instruments are mounted in panel doors or plates, the mounting devices, clips, and brackets shall be type provided by the Instrument Manufacturer or shall be specifically fabricated for the purpose. All panel mounted instruments shall have enclosures that cover any exposed circuit boards or components on the back side of the instrument.
7. Components are to be attached with bolts, washers, and nuts properly sized and made for the purpose applied. Screws or self-tapping screws are not acceptable for mounting components, except self-tapping stainless screws shall be used for mounting nameplates.

8. Do not mount temperature sensitive devices near heat producing components such as resistors or transformers.
9. Arrange all devices for easy identification, removal, and repair. Removal of any device shall not require removal or disturbing other components.
10. Wet devices shall be located in lower part of panel or cabinet with metallic spray shield installed above, separating other electrical devices.
11. DIN rail mounted devices shall be made for purpose and shall be standard sized components. Micro and miniature type components are not acceptable. Provide additional 8-inch DIN rail for future devices for water plant and wastewater plant control panels.
12. All devices shall be of type that is readily available and not special order type components that are not standard manufactured units.
13. All components, parts, and devices are to be identified at their locations with approved labels or nameplates. Provide 8 ½ x 11 inch laminated parts list in steel or hard plastic door pocket along with the control diagrams.
14. All over current devices shall be fast acting circuit breakers. Fuses are not allowed except where specifically called for. Where fuses are specified, provide ten (10) each spare fuses in addition to requirements of other specification sections.
15. Fused circuits are not acceptable for power or control devices. Circuit breakers shall be used for all overcurrent protection purposes. Any use of fuses shall be acceptable where specifically approved by Engineer in writing for each specified panel.
16. All display screens or readouts shall be mounted in panel at height of 60 inches above level where operator stands. This must be accounted for where panels are installed on concrete pads or other elevated structures.
17. Where standard MCC controls section shown on Plans will not contain all devices on backplate, provide additional plate hinged to side of section wall for mounting additional devices. Space location to all clearance from devices on backplate.

18. Where UPS units are required and are a part of the control system, allow adequate space inside enclosure for installation of UPS unit. Coordinate with MCC manufacture where UPS may be installed inside a designated MCC section.

C. Terminals:

1. All terminations for interfacing with external wiring shall be via screw type terminal strips that have numbered markings to identify termination points. All terminals to have compression plates made specifically for the purpose, in addition to the screws. Round washers are not acceptable substitute for the compression plates.
2. All terminals or exposed wiring with more than 120 volts to ground or 300 volts between legs are to be shielded with non-metallic, non-conducting insulating material made for the purpose of avoiding accidental contact. Label all shields and devices in a recognizable manner with warning nameplate or sign.
3. Locate terminal strips in accessible location in panel to allow easy access when making terminations. Provide nameplate for each terminal strip.

D. Miscellaneous:

1. Door fasteners shall be of highest quality, designed to withstand repeated engagement and disengagement without damage to retaining parts, which shall be firmly attached to the panel frame members. Fasteners shall be properly aligned with retainer parts. Lightweight fasteners are not acceptable. Any fasteners failing before warranty period expires shall be replaced with different type fastener that is acceptable to Owner and Engineer.
2. All outdoor panel doors to be NEMA 4X 316 stainless steel unless specifically noted on plans, with three (3) point latching handle and locking hasp. Key type handles are not acceptable. No control devices are allowed on outer door of outdoor enclosures.
3. All attachments and studs that are welded to stainless steel panel, enclosure, or plate shall be properly welded in such a manner that does not discolor finish. All welds shall be properly cleaned, buffed, and treated to provide a neat appearing finish. Any discolored plates or enclosures shall be replaced.

4. Panel Manufacturer shall send Engineer color photographs or e-mail color photo files of finished panel where shop inspection has not been conducted before shipping. Photos shall be of quality and clarity so as to allow evaluation of finished panel quality. No panels shall be delivered to job site without this review and approval in writing by Engineer and, where delivered without this approval may be rejected by Engineer. Any delay in construction schedule due to failure to satisfy this requirement will be at fault of Contractor.
 5. Provide laminated 8 ½ x 11 inch control diagrams that show all components, wiring, and terminals and enclosure in aluminum, steel or hard plastic door pocket. Diagrams must be identical to as-built drawings and O&M Manuals and show latest configuration of construction.
 6. Provide 120-volt GFI type receptacle and 12 inch or 24 inch florescent, enclosed, weather tight, light fixture in each outdoor panel. Provide door switch to activate light. Provide separate circuit breaker for receptacle and light that is not common to any control circuits. Provide 120-volt space heater with thermostat control.
 7. All hydraulic or pneumatically operated devices to have shut-off valves. Provide block and bleed valves for all autosensory lines. Route bleed line to outside panel and outside rooms. All autosensory lines entering panel shall be via bulkhead connectors made for that purpose.
- E. Programming: Where specifications require programming to be conducted by “Programmer,” contractor shall provide all software and coordinate loading and testing.
- F. Cabinet and Enclosures Heights: Cabinet, panel, and enclosure heights shall not exceed 6 feet – 6 inches from floor to top fastening devices to allow access by Operator without use of ladders or steps to open enclosure doors.
- G. All equipment control panels shall have heaters to remove condensation and shall have satisfactory means of cooling to maintain temperatures below the warranty levels of each device installed inside the enclosure cabinets. Outdoor enclosures shall be NEMA 4X stainless steel and rated to operate in 120 degree Fahrenheit ambient temperatures at 95 percent humidity. Provide thermoelectric cooling units attached to cabinets where cooling is required. Provide cabinet interior insulating and drip panel with drain line routed out of cabinet.

- H. Relocation of panels up to 40 feet from where shown may be required and shall be included in bid cost.
- I. Adhesive attachments are not allowed.
- J. All control panels that have a solid-state controller or PLC, shall have data port for interconnection to plant PLC via Ethernet link. Contractor to route data cable to plant PLC.
- K. All control panels shall have over current protection or disconnect switch for power feeders.
- L. All equipment installed on this project shall incorporate all devices and features to protect that equipment from the influence of other equipment, line voltage and phase irregularities, harmonics and other disturbances that may effect the proper and safe operation of that equipment weather these required features are a standard component of that equipment as an off-the-line product. No equipment shall be installed without these features.
- M. Controls shall have HOA switch and circuits that allow automatic restart of controls after momentary power interruption, without reset action required. Lock-in push button controls are not allowed. Provide time delay for restart.

2.01 CONTROL SWITCHES

- A. Manufacturers:
 - 1. Square D Class 9001, Type K
 - 2. Cutler-Hammer 10250T
 - 3. Allen Bradley 800T
 - 4. Or, pre-approved equal
- B. Construction:
 - 1. Heavy duty
 - 2. Watertight
 - 3. Oiltight

4. Base mounting
 5. Flush panel mounting
 6. Size to mount in 30.5 mm diameter opening without adapter. Smaller units are not acceptable.
 7. Padlock attachments, where required, constructed of metal. Plastic material is not acceptable.
 8. Legend plates, as required, for type of operation or as specified elsewhere.
- C. Pushbuttons:
1. Flush head unless specified elsewhere.
 2. Contact Blocks:
 3. Double break silver contacts
 4. AC Ratings: 7,200 VA make, 720 VA break
 5. Single pole, double throw or double pole, single throw
 6. Up to six (6) tandem blocks
 7. Pushbutton “Run/Stop” switches for motor controls not allowed. Use selector switches only.
 8. Maintained contact unless specified elsewhere.
 9. Non-illuminated.
 10. Legend plates, as required, for type of operation or as specified elsewhere.
 11. Selector Switches:
 12. Maintained position unless specified elsewhere.
 13. Contact Blocks:
 14. Double break silver contacts

15. AC Rating: 7,200 VA make, 720 VA break
16. Single pole, double throw or double pole, single throw
17. Up to six (6) tandem blocks
18. Operators:
19. Number of positions as specified elsewhere
20. Standard knob type unless specified elsewhere

D. Pilot Lights:

1. LED, high visibility type
2. Colored lenses as specified elsewhere
3. Interchangeable lenses
4. Push to test
5. Legend plates as specified elsewhere

2.02 MOTOR STARTER CONTROL RELAYS

A. Manufacturers

1. Square D
2. Cutler Hammer
3. Or pre-approved equal

B. Construction:

1. Industrial type
2. 300 V rated
3. AC operation
4. Pressure wire connectors

5. Operating Data:
 - a. Pickup Time: 11 ms maximum
 - b. Dropout Time: 6 ms maximum

6. Coil:
 - a. Molded construction
 - b. 120 VAC, 60 Hz
 - c. Continuous rated
 - d. Color coded to indicate status
 - e. Pilot duty
 - f. 60A make, 6A break, (120V inductive)
 - g. Contacts:
 - h. Double break
 - i. Silver alloy
 - j. Convertible
 - k. Color coded to indicate status
 - l. Pilot duty
 - m. 60A make, 6A break, (120V inductive)
 - n. Track mounting capability

7. Accessories:
 - a. Add-on pole attachment
 - b. 4 NO and 4 NC contacts
 - c. Add-on to 0 to 4 pole relay

- d. Latch attachment
 - e. Pneumatic Timer Attachment:
 - f. Single pole, double throw, double break timed contact
 - g. Adjustable 0.2 to 60 sec.
 - h. Repeat accuracy of + 15 percent
 - i. Convertible timing modc.
 - j. Transient Timing Mode: Suppress coil transients to 300 V or less.
8. CONTROL RELAYS
- a. Contacts: NEMA ICS 2; three (3) Form C contact sets.
 - b. Rating: NEMA ICS 2; 120 volts, 10 amperes inductive.
 - c. Coil Voltage: 120 volts, 60 Hz, AC, or, as shown on Plans.
 - d. Features: 11 pin tube socket relay base, external color-coded test button, mechanical and electrical status indications, impact resistant thermoplastic case.
 - e. Manufacturer: Turck, Inc. or approved equal, unless shown otherwise on plans.
9. TIME DELAY RELAYS
- a. Contacts: NEMA ICS 2; three (3) Form C contact sets.
 - b. Contact Ratings: NEMA ICS 2; DPDT Class 120 volts, 10 amperes inductive.
 - c. Coil Voltage: 120 volts, 60 Hz, AC, or, as shown on Plans.
 - d. Description: Control relay as specified above with added Time Cube Module as manufactured by Turck, Inc., series CT3, on or off delay as indicated.

- e. Features: DIPswitch selectable timing ranges of 0.2-3 sec, 0.8-12 sec, 0.1-1.5 min and 0.8-12 min (unless noted otherwise on plans); externally adjustable graduated time dial; solid-state digital timing system.

10. CONTROL POWER TRANSFORMERS

- a. Transformer: NEMA ST 1; machine tool transformer with isolated secondary winding.
- b. Power Rating: 250 VA or 200 percent power requirement (whichever is greater).
- c. Voltage Rating: 120/240 volts primary; 120 volts secondary, one-phase.

11. TERMINAL BLOCKS

- a. Manufacturers:
 - 1) Entrelec, Inc.
 - 2) General Electric Company
 - 3) Bussmann
 - 4) Or, equal

12. Terminal Blocks: Provide terminal blocks with circuit breaker overcurrent protection.

- a. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- b. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- c. Provide ground bus terminal block, with each connector bonded to enclosure.

13. MISCELLANEOUS DEVICES
 - a. Manufacturer: As shown on plans.
 - b. Description: As shown on plans.
 - c. As described in Section 16936 – “Pilot and Miscellaneous Control Devices.”
14. DATA LINE PROTECTION - (AS SHOWN ON PLANS OR SPECIFIED IN OTHER SECTIONS)
15. ACCESSORIES
16. Plastic Wireway:
 - a. Panduit Corp.
 - b. Anixter Brox., Inc.
 - c. Delaware Industries, Inc.
 - d. Description: Plastic slotted wireway with snap-on locking covers. White or grey color.
 - e. See Item 2.01 – “Panel Construction” for size restrictions.
17. ELAPSE TIME METER
 - a. Manufacturers:
 - 1) Cramer #635G/HRS.
 - 2) Digits: Five (5), non-resettable
 - 3) Power: 120 VAC, 60 Hz.
 - b. Manufacturers:
 - 1) Cramer #635S surface mounted.
 - 2) Digits: Five (5), non-resettable

3) Power: 120 VAC, 60 Hz

18. TIMERS

- a. 24-hr Clock Timer (Repeat Cycle):
- b. Manufacturers:
 - 1) Tork Time Controls
 - 2) Intermatic
 - 3) Or pre-approved equal
- c. Mounting: Surface
- d. Display: 24-hr LCD
- e. Contacts: One (1) SPDT rated 20 A
- f. Set Points: 288 per 24 hr.
- g. Skip Feature: 1 to 7-day adjustable
- h. Minimum On-Off Time: 5 min.
- i. Time cycle programmable by keypad
- j. Power: 120 VAC, 60 Hz
- k. Interval/Duration Timer (Rear of Panel):
- l. Manufacturers: As indicated on drawings.
- m. Mounting: Plug-in with dust tight cover
- n. Type: Integrated circuit
- o. Range: As indicated on drawings
- p. Contacts: Two (2) DPDT contacts rated 10 amp
- q. Power: 120 VAC, 60 Hz.

19. PRESSURE SWITCHES

- a. Prosense PSD25 Series Pressure Switch, Model No. PSD25-OP-145H or other model as required.
- b. Bourdon Tube Pressure Switches with SPDT or DPDT mercury switch, adjustable dead band/differential, shall be used for all pump control and alarm applications. Size for range required. (Where shown on plans.)
- c. Mercoid Series DA and DS Bourdon Tube Pressure Switches, NEMA 4 weatherproof enclosure, manual reset, SPDT, mercury switch rated 4 amps at 120 volts. (Where shown on plans.)
- d. Mercoid Series BB Differential Pressure Switches, Bourdon Tube, SPDT, mercury switch rated 4 amps at 120 VAC. (Where shown on plans.)
- e. Mercoid Series PQ Ultra Sensitive Large Diaphragm Pressure Switches, where application requires.
- f. Electronic, adjustable dials, pressure switch. Prosense Series PSD25 with factory cable.
- g. No exceptions for manufacturer, series, or type switches without written approval.

20. ALTERNATOR

- a. Manufacturers:
- b. Diversified Electronics:
 - 1) Two (2) Pump Duplexor:
 - a) 24 VAC/DC, ARA-24-ABA.
 - b) 48 VDC, ARA-48-ABA
 - c) 120 VAC/DC, ARA-120-ABA
 - d) 208 VAC, ARA-208-ABA

- e) 240 VAC, ARA-240-ABA
 - 2) Three (3) Pump Triplexor:
 - a) 24 V, ARA-24-AFE
 - b) 120 V, ARA-120-AFE
 - 3) Four (4) Pump Quadraplexor:
 - a) 24 V, ARA-24-AGE
 - b) 120 V, ARA-120-AGE
 - 4) Equal by other Manufacturers
 - c. Two (2) or Three (3) Pump Duplexor/Triplexor: 120 V, ARA-120-AME
 - d. Three (3) or Four (4) Pump Triplexor/Quadraplexor: 120 V, ARA-120-ANE
 - e. Time Mark Corporation: 120 V, B 471
 - 1) Or equal as pre-approved by Engineer
 - f. Provide automatic alternation of energizing motor starters.
 - g. Permit operation of units singly or together as called by pilot devices.
 - h. N.O. auxiliary contacts from motor starters required to operate alternator.
 - i. Alternator shall provide for operation of standby or lag unit through second pilot device in event of failure of lead unit or first pilot device or alternator coil.
 - j. With pump selector switch for operation of two (2), three (3), four (4) and five (5) pump systems.
21. PHASE FAIL RELAY
- a. Diversified Electronics #SLD-440-ALE, 480 Volt, 3 Phase.

- b. Diversified Electronics #SLD-220-ALE, 240 Volt, 3 Phase
 - c. Pre-approved equal
22. UNIVERSAL AC CURRENT SENSOR
- a. Manufacturer:
 - 1) SSAC, Inc. – P.O. Box 1000, Baldwin, NY, 13027
 - 2) Or, approved equal.
 - b. ECS, ECSH, and ECSL Series: Provides relay contact closure when current reaches pre-set level.
 - c. Install per Manufacturer’s instructions.
 - d. Sensor to be rated at 125 percent of current rating.
23. CURRENT TRANSDUCER
- a. Manufacturers:
 - 1) NK Technologies
 - 2) Ohio Semitronics, Inc.
 - 3) Or, approved equal
 - b. AT Series: Current transformer with signal conditioner. Split or solid-core as applicable. 420 model with 4–20 mA output. Self powered. 0 – 200 amp range. U.L. listed.
 - c. A.C. Current Transformer Model No. MCT5, 005E or 005E2 (as shown on plans) with Manufacturer’s recommended CT rated per circuit maximum amps x 1.25.
 - d. AT/ATR Series: 0 – 200 amp range or, as required by motor current rating.
 - e. Transducer to be rated for 125 percent of current rating.
 - f. Size unit to detect peak inrush current of motor.

24. VOLTAGE TRANSDUCER
 - a. Manufacturer:
 - 1) Ohio Semitronics, Inc.
 - 2) Or, approved equal
 - b. A.C. Voltage Transducer Model VT, rated per circuit maximum voltage x 1.25. Select version that matches shown on plans.
 - c. Transducer to be rated for 125 percent of current rating.

25. DC INPUT, FIELD CONFIGURABLE ISOLATOR
 - a. Manufacturer:
 - 1) Action Instruments, Model ACTIONI/Q Q406
 - 2) Or, approved equal.
 - b. Construction:
 - c. Provides one or two fully isolated DC output signals in proportion to one or two DC inputs.
 - d. Field Configurable: 4-20 ma, 0-1 ma, 0-10V or 0-20 ma.
 - e. 120 V power source.

26. SIGNAL CONVERTER/ISOLATION AMPLIFIER
 - a. MCR-C Series manufactured by Phoenix Contact.
 - b. Voltage to current and current to voltage conversion.
 - c. Current to current isolation amplifier.

27. ADDITIONAL DEVICES
 - a. See Section 16936 – “Pilot and Miscellaneous Control Devices” for additional devices.

PART 3 EXECUTION

3.00 SYSTEM DESCRIPTION

- A. Use control diagrams on plans, equipment manufacturer's data, P&ID's, Flow Diagrams, electrical plans and all other information in Construction Documents to verify intent of system controls before preparing shop drawing diagrams for Engineers review and acceptance.
- B. Where control sequence is not clear or, where not familiar with type of control, consult Engineer for clarification.

3.01 TESTING AND STARTUP

- A. All elements of each electrical control system shall be set up, calibrated, and tested by Manufacturer's Technician to demonstrate that the total system satisfies all of the requirements of this Specification. All special testing of materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner and Systems Integration Engineer. As a minimum, the testing shall include both a factory test and a field test. Testing requirements are as follows:
 - B. **Factory Tests:** The electrical controls, motor control centers, switchgear, SCADA, instrumentation systems, and all other associated hardware shall be tested via a full simulation at the factory, prior to shipment, to demonstrate that each component is operational and meets the requirements of these specifications. Manufacturer shall provide test routine program for shop testing of I/O wiring.
 - C. Where solid-state controller programs are furnished by a specified Systems Integration Programmer, a copy of the program will be provided on CD for Manufacturer's use in factory testing.
 - D. Test results shall be certified, with written documentation provided to the Engineer upon test completion. Factory testing may be witnessed by the Engineer and/or Programmer.
 - E. **Field Tests:** All electrical control system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly.

- F. Witnessed field tests shall be performed on the complete system. Prior to witnessed test, Contractor shall perform a complete test of each and every function, device operation and overall operations of electrical power, control, instrumentation and SCADA system. Prior to loading PLC or SCADA programming and prior to any PLC or SCADA set up by programmer, an inspection shall be conducted by Engineer's Inspector to assure electrical controls are functioning properly. Any discrepancies or problems shall be corrected and then Contractor shall send a written notice that complete electrical control system is installed and operating per the Plans and Specifications. This notice shall be signed by an Officer of the General Contractor's company.
- G. Contractor shall provide a checklist for all electrical, control and instrumentation functions and send to Engineer for approval.
- H. Each function shall be demonstrated to the satisfaction of the Owner and Engineer on a paragraph-by-paragraph basis. Any equipment, devices or functions that are found not performing properly will be reason for termination of test until repairs are made. Additional testing by Engineer and Owner may be at Contractor's expense for time and travel of Engineer and Owner's staff. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion. The equipment Manufacturer's Representative shall be present for all testing, setup, demonstrations, and training. The Contractor shall notify the Owner at least two (2) weeks prior to the commencement date of the field tests. After tests are completed and with system fully operational, system shall run continuously for a period of 90 days without failure. Any failures shall be repaired and test shall start over again.

3.02 Additional Requirements:

- A. Provide instrument and electronic devices calibration ranges and scales for this specific project. (Manufacturer's general information is not sufficient. Include range of 4-20 mA signals, i.e., 4 mA = X psi or Y feet, etc. for each specific instrument and device.)
- B. Provide setting and adjustments of all solid-state and non-solid-state starters, circuit breakers, controllers and other equipment with adjustable settings both manual and programmable settings.

- C. Provide statement of satisfactory demonstration of all instruments, devices and equipment functions over full range of operation. (Any failures or incorrect calibrations or settings detected shall be reason to halt demonstration tests and reschedule after adjustments and recalibrations have been completed.)
- D. Factory Technician report stating that all calibrations, settings and adjustments have been completed and that equipment has been functionally tested by Factory Technician on site. (Where report is found to be inaccurate, the Technician shall make necessary on site adjustments and shall issue new report, and where second report is required, a Factory Manager shall sign report attesting to its accuracy. There is no exception to this requirement.
- E. Contractor shall be responsible for all factory set up, testing and demonstration costs until system is accepted by the Design Engineer. Any additional testing as result of non-acceptance by Engineer shall be at Contractor's expense.
- F. 5) As-Built Drawings (Point to point wiring diagrams for every electrical device installed on this project with tags and applicable schedules shall be available at time of testing. Lack of this requirement will result in cancellation of testing until complete documentation is available. This will allow checking of wiring accuracy at time of testing.)
- G. A state licensed Electrician shall be present at all scheduled inspections.
- H. Controllor Program: Remote testing by Engineer will require a minimum of 30 working days after programs are downloaded to the controller. Provide six (6) weeks' notice for program downloading by Programmer. This shall be accounted for in project schedule. Any delay of project completion due to lack of notice is at Contractor's risk and expense.
- I. Prior to testing system, PLC programs or HMI programs provided by other than the Systems Integration Engineer, programs shall be furnished on CD for review by Engineer. Provide any special software necessary to run and test complete program.
- J. Modem and/or radio system setup shall be conducted by Manufacturer's Technician before any field-testing by Engineer is performed. Set up per Manufacturer's written instructions. Provide Engineer with checklist and values of all settings and adjustments before requesting field test by Engineer. Indicate impedance of terminal load resister at each end of modem line.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and intent of Contract Drawings. Provide sufficient clearance for calibration and maintenance access.
- B. Do not install products until major construction is complete and building interior is enclosed and heated.
- C. Install control panels, instruments, and motor control centers, to allow a minimum of four (4) feet clearance for access to control devices.
- D. Connect input and output devices as shown or, as intended, on Drawings.
- E. Provide complete testing.

3.04 DEMONSTRATION

- A. Provide systems demonstration in presence of Owner and Engineer.
- B. Demonstrate operation of Controls.
- C. System demonstration to include the following:
- D. Complete verification of all field wiring.
- E. Demonstration of functionality of each field device action.
- F. Complete demonstration of each alarm by simulation of actual field device action.
- G. Coordinate any programming requirements with Programmer as described in controller, PLC, RTU or CCU, SCADA, and other specification sections.

3.05 TRAINING

- A. Provide minimum eight (8) hours of “hands-on” instruction each for Owner’s staff. To be conducted at project site by control systems manufacturer’s representative, at no additional cost to Owner. Training is to be conducted after all control systems are fully operational. To include PLCs and other devices. See Section 16012 – “Electrical Work” for additional requirements and refer to other equipment
- B. Provide minimum two (2) weeks notice to Engineer and Owner before conducting training.

3.06 WARRANTY

- A. Contractor shall provide full 3-year service warranty on the overall installation, and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software.
- B. This warranty shall begin on date of written “Final Acceptance” of the electrical systems to be executed as required at no additional cost to the Owner.
- C. Contractor’s warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed.
- D. Where Manufacturer’s products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its affect on the product.
- E. Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor’s expense and at no additional cost to the Owner.
- F. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.
- G. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

END OF SECTION

SECTION 16060
ELECTRICAL DEMOLITION

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - "Electrical Work" for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SECTION INCLUDES

- A. Electrical Demolition

1.02 REFERENCES

- A. Temporary wiring of systems to maintain operation of facilities while undergoing modifications and demolition shall be provided in accordance with:
 - 1. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC), Article No. 590 - Temporary Installations.

1.03 SUBMITTALS

- A. Submit all products covered under this section for Engineer's approval.
- B. Annotate existing drawings to sequence the demolition of systems, equipment removal, and temporary hook-ups.
- C. Schedule with Owner for required shutdowns to accommodate system demolition and installation of temporary facilities.
- D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 QUALITY ASSURANCE

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents. Report any discrepancies to Engineer before disturbing existing installation.
- D. By beginning demolition, installer accepts existing conditions and warrants that he will maintain service to equipment and items not scheduled or indicated for removal, and that he will return to the Owner all serviceable items and systems in good operating conditions.
- E. Before starting demolition test installation and verify operating condition of all equipment that is to remain serviceable. Notify Owner in writing of any equipment that is not operable.

PART 2 PRODUCTS

2.00 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections, or as required to complete work intended by plans and specification.

2.01 DESIGN AND CONSTRUCTION

- A. The temporary electrical wiring and facilities shall be designed and constructed in strict compliance with NEC - Article No. 590.

PART 3 EXECUTION

3.00 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with Utility Company to provide continuous service to operating equipment.

- C. Where required, provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switch-overs and connections. Obtain permission from the Owner at least one week before partially or completely disabling system. Minimize outage duration.
- E. All existing equipment that is to remain serviceable shall be covered and sealed to prevent dust or water intrusion.
- F. Where equipment, motor control centers, panels, and devices are to be removed or relocated and where wiring is to remain or be reused, trace out all wiring and tag conductors. Record data in Record Drawings.
- G. Where equipment is to be reused and is disabled without power for a period of over 1 week, the equipment shall be stored in a dry location and a heater shall be installed inside the enclosure and remain activated until equipment is placed back in service.

3.01 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work as shown on plans, and as understood from observable conditions noted during the pre-bid site visit.
- B. Remove, relocate, and extend existing installations to accommodate new construction. This includes rerouting of underground duct banks and conduits that may not be documented on Owner's record drawings. Contractor is to allow for these conditions in bid price. Failure to do so is at Contractor's risk.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, plug conduit, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.

- G. Disconnect and remove electrical devices and equipment servicing utilization equipment that has been removed.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing installations, which remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods as specified for new work.
- K. Any existing equipment that is to remain serviceable and is damaged during demolition or during new work shall be repaired or replaced to Owner's satisfaction in working condition.

3.02 DISPOSAL AND SALVAGE

- A. Salvage electrical and instrumentation equipment removed from existing facilities for reuse as applicable.
- B. Material and equipment, which can be reused or salvaged, remains the property of the Owner unless specifically indicated in the Specifications or Drawings, or as designed by the Owner.
- C. Materials and equipment which cannot be reused or salvaged for Owner's use will be removed and disposed by the Contractor at approved disposal facility.
- D. Remove, seal, and store generators, motors, and other large equipment for Owner's use. Store at designated location wrapped in water and dust tight covering and on skids.

3.03 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment, which remains or is to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangements.

3.04 **INSTALLATION**

- A. Install relocated materials and equipment as shown on plans.

END OF SECTION

SECTION 16111
CONDUIT, FITTINGS, AND BODIES

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - "Electrical Work" for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SECTION INCLUDES

- A. Specification for conduit, fittings, and bodies.

1.02 REFERENCES

- A. American National Standards Institute (ANSI).
 - 1. ANSI C80.1: Rigid Steel Conduit - Zinc Coated.
 - 2. ANSI C80.4: Fittings for Rigid Metal Conduit.
- B. Federal Specifications.
 - 1. W-C-58C: Conduit Outlet Boxes, Bodies Aluminum, and Malleable Iron.
 - 2. W-C-1094A: Conduit and Conduit Fittings Plastic, Rigid.
 - 3. WW-C-566C: Flexible Metal Conduit.
 - 4. WW-C-581E: Coatings on Steel Conduit.
- C. National Electrical Manufacturers Association (NEMA).
 - 1. NEMA RN1: Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
 - 2. NEMA TC2: Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

3. NEMA TC3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- D. National Fire Protection Association (NFPA), ANSI/NFPA 70 - National Electrical Code (NEC).
- E. Underwriters' Laboratories (UL).
 1. UL 1: Flexible Metal Electrical Conduit.
 2. UL 6: Rigid Metal Electrical Conduit.
 3. UL 514B: Fittings for Conduit and Outlet Boxes.
 4. UL 651: Schedule 40 and 80 Rigid PVC Conduit.
 5. UL 651A: Type EB and A Rigid PVC Conduit and HDPE Conduit.
 6. UL 886: Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.
- F. ETL verified PVC-001 for PVC coated rigid steel conduit.
- G. Section 16195 – “Electrical Identification”

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer’s approval.
 1. Manufacturer's cut sheets, catalog data, with selected products clearly marked.
 2. Installation, terminating and splicing procedure.
 3. Instruction for handling and storage.
 4. Dimensions and weight.
- B. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 QUALITY ASSURANCE

A. Tests:

1. Rigid steel conduit shall pass the bending, ductility, and thickness of zinc coating tests described by ANSI C80.1.
2. Flexible conduit shall pass the tension, flexibility, impact, and zinc coating test described by UL 1.
3. Nonmetallic conduit and fittings shall pass the test requirements of NEMA TC2, UL 651 and 651A and Federal Specification W-C-1094A.

1.05 DELIVERY STORAGE AND HANDLING

- A. Package conduit in 10-foot bundles maximum with conduit and coupling thread protectors suitable for indoor and outdoor storage. Package fittings in manufacturer's standard quantities and packaging suitable for indoor storage. Package plastic-coated rigid conduit, fittings, and bodies in such a manner as to protect the coating from damage during shipment and storage.
- B. Store conduit above ground on racks to prevent corrosion and entrance of debris.
- C. Protect plastic conduit from sunlight.

PART 2 PRODUCTS

2.00 ACCEPTABLE MANUFACTURERS

A. Rigid Steel Conduit.

1. Allied Tube and Conduit
2. Western Tube and Conduit
3. Wheatland Tube Company

B. PVC Coated Steel Conduit.

1. Occidental Coating Company (O-Cal Blue)

2. Robroy Industries, Inc. (Rob-Roy Red)
 - C. PVC Rigid Conduit.
 1. Cantex
 2. Carlon Industries, Inc.
 3. Robroy Industries, Inc.
 - D. Conduit Fittings and Bodies.
 1. Appleton Electric
 2. Crouse-Hinds
 3. Killark Electric Manufacturing Company
 4. O-Z/Gedney
 - E. Liquidtight Flexible Conduit.
 1. Anamet, Inc.
 2. Electriflex Company
 3. Triangle Wire and Cable, Inc.
 - F. Aluminum Conduit:
 1. Allied Tube and Conduit
 2. Indalex
 3. Or equal
- 2.01 MATERIALS AND EQUIPMENT
- A. Design Conditions. Use electrical conduit, fittings, and bodies designed for service in areas as specified within this section to form a continuous support system for power, control, and instrument cables.

1. Use PVC coated steel conduits and hardware for Wastewater Facilities or corrosive environments.
 2. Use rigid galvanized steel conduits for Water Facilities.
- B. Conduit and Fittings
1. Rigid Steel Conduit and Fittings:
 - a. Rigid steel conduit, rigid steel conduit bends, nipples, and bodies shall be hot-dipped galvanized and shall comply with the latest ANSI C80.1, UL 6, Federal Specification WW-C-581E, and NEC Article 344.
 - b. Mild steel tubing shall be used for conduit, nipples, and couplings, and shall be free of defects on both the inner and outer surfaces.
 - c. Fittings, bodies, and covers for rigid steel conduit shall be steel or cast-iron and shall comply with ANSI C80.4, UL 514B, and Federal Specification W-C-58C.
 2. PVC-Coated Rigid Steel Conduit and Fittings.
 - a. PVC-coated conduit, fittings, bodies, and covers shall conform to NEMA RN1 (Type A). Rigid steel galvanized conduit and fittings before coating shall conform to Federal Specification WW-C-581E, ANSI C80.1, and UL 6. Conduit bodies shall conform to UL 514B and Federal Specification W-C-58C. Provide sufficient coating for touch up after installation.
 - b. PVC-coated couplings shall be of the ribbed type.
 - c. Condulet covers shall have encapsulated stainless steel thumbscrews.
 - d. Condulets and covers shall be of malleable iron or ferrous material before coating.
 - e. PVC coating shall be a minimum of 2-mil thickness on the interior of the conduit and the interior of fittings, condulets, covers, and bodies.

- f. Conduit clamps, unistrut, and devices shall be PVC coated when used with PVC-coated conduit.
- 3. Flexible and Liquidtight Flexible Metal Conduit and Fittings.
 - a. Use liquidtight flexible metal conduit manufactured in accordance with UL 1 and Federal Specification WW-C-566C.
 - b. Fittings used with liquidtight flexible metal conduit shall be the PVC-coated type and of such design as to thoroughly ground the conduit to the fittings and through it to the box or enclosure to which it is attached.
 - c. Liquidtight flexible couplings and fittings for use in hazardous areas shall comply with UL 886, NEC Article 501-10 (A&B), and Federal Specification W-C-586C.
 - d. Do not use flexible metal conduit or liquidtight flexible metal conduit for light fixtures or receptacles unless shown on plans or approved by Engineer.
- 4. PVC Conduit and Fittings. Use PVC conduit, bends, and fittings, which comply with NEMA TC2, W-C-1094A, and NEC Article 352-III for above ground and underground installation. Conduit shall be Schedule 80, unless shown or noted otherwise on drawings or in other specifications.
- 5. Use PVC Schedule 80 conduits, fittings, and boxes for all chemical areas and provide conduit seals per NEC.
- 6. Aluminum RMC conduit may be used only where shown on plans.
- 7. Do not use liquid tight flexible metallic conduit to connect rigid conduit to fixed or wall mounted enclosures or panels.
- 8. Do not run liquid tight flexible metallic conduit directly thru walls, ceilings, or floors.
- 9. Do not attach liquid tight flexible metallic conduit with nylon or plastic tie-wraps on straps. Use aluminum straps made for that purpose, except where approved by Engineer.

PART 3 EXECUTION

3.00 PREPARATION

- A. Confirm submittal of shop drawing with conduit and conduit fitting, sizes, types, and routing shown.
- B. Ensure that the conduit system to be installed is sized properly for the cable and wire requirements.
- C. Verify the actual physical conduit route from the conduit plan drawings and prepare the conduit support system.
- D. Verify the equipment locations to which the conduit will be connected and determine detail requirements for connections.
- E. Submit layout of all conduit stub-ups for Engineers review before installing conduits. Do not install conduit to equipment, electrical panels or devices until enclosure locations and sizes have been determined and verified by Supplier.

3.01 INSTALLATION

- A. Install PVC-coated conduits in all locations at wastewater facilities, inside valve vaults, in wet well slabs, in corrosive and wet environments, in chemical rooms (Schedule 80 required) and, where specifically noted on drawings. Aluminum PVC-coated conduit may be used where specifically shown on plans, where specifically noted in specifications or where approved in writing. Install PVC coated conduits in Water Facilities where wet locations, inside valve vaults, or where specifically shown on Plans or noted in other Specifications.
- B. Install rigid galvanized steel (RGS) conduits in dry inside locations and in all outdoor locations for water facilities and, where specifically noted otherwise on drawings. Aluminum RMC may be used where specifically shown on plans, where specifically noted in specifications or where approved in writing. Where aluminum conduit is approved, use all aluminum condulets and fittings.
- C. Install PVC conduits in duct banks. For stub-ups and directional turn elbows, use PVC-coated rigid steel elbows or rigid steel elbows as applicable in A and B above and other specifically noted locations on drawings. Rigid steel stub-up shall have minimum three (3) layers of mylar tape up to 1" above slab where conduit is in contact with concrete.

- Stub-ups inside MCC's, panels, equipment and/or enclosures shall have threads with grounding bushings installed.
- D. Stub up all conduits entering MCC's, and other equipment enclosures from the bottom into each respective starter, feeder breaker or control section per equipment manufacturers conduit layout detail. Coordinate with equipment manufacture data sheets before starting any underground or below slab conduit installations.
 - E. Run exposed conduit parallel or perpendicular to walls, ceilings, or main structural members. Group multiple conduits together where possible. Do not install conduit where it interferes with the use of passageways, doorways, overhead cranes, monorails, equipment removal areas or working areas. In no case shall conduit routing present a safety hazard or interfere with normal plant operating and maintenance procedures. Maintain a minimum overhead clearance of 8'-0" in passageways. Except where absolutely impossible, all conduits are to be installed in or under concrete slab, in walls and ceilings. Any exposed conduit installed otherwise may be relocated at Contractor's expense where directed by Engineer or Owner. Exceptions, where specifically noted otherwise on plans.
 - F. Installation and support of conduit shall be from steel or concrete structures in accordance with the standard detail drawings. Furnish necessary conduit straps, clamps, fittings and support for the conduit in accordance with the standard details and consistent with the grade and type of conduit being installed.
 - G. Identify conduit at termination points like MCC, light fixtures, control panels, receptacles, and junction boxes. Tag all conduits per Section 16195 – "Electrical Identification," Item 2.01 – "Raceway and Cable Labels."
 - H. Not more than three (3) equivalent 90 degree bends will be permitted between pullboxes, or between pullboxes and equipment. Provide bonded expansion fittings at building expansion joints. Where pullboxes are located such the three 90 degree bend rule is not exceeded without the pullbox, the box may be deleted where approved by Engineer in writing.
 - I. Install conduit runs so that they are mechanically secure, mechanically protected from physical harm, electrically continuous, and neat in appearance. The interiors of conduit shall provide clean, smooth raceways through which conductors may be drawn without damage to the insulation. Make threaded connections wrench tight.

- J. Cut conduit square with a power saw or a rotary type conduit cutter designed to leave a flat face. Do not use plumbing pipe cutters for cutting conduit. Ream the cut ends of conduit with a reamer, designed for the purpose to eliminate rough edges and burrs. Cut threads with standard conduit dies providing 3/4-inch taper per foot, allowing the proper length so that joints and terminals may be made up tight and the ends of the conduit not deformed. Keep dies sharp and use a good quality threading oil continuously during the threading operation. Remove metal cuttings and oil from the conduit ends after the threads are cut and paint threads before connections are made. Use zinc rich, brush-on compound on the threads of steel conduit before connections are made. Use only tools specifically made for bending and installing PVC-coated or PVC conduit when installing these materials.
- K. Use strap wrenches only to tighten joints in plastic coated rigid steel conduit. Replace all conduit and fittings with damage to the plastic coating, such as cuts, nicks and threader chuck jaw marks.
- L. Make up changes in direction of exposed conduit using elbows or fittings. Do not use pull boxes to make direction changes unless specifically designated otherwise. Do not use elbow bends for change in direction of exposed conduit.
- M. Field fabricated bends shall be free of indentations or elliptical sections. The radius of the bend shall not be less than 6 times the smallest diameter of the raceway.
- N. Protect all conduit terminations from mechanical injury. Prevent the entry of moisture and foreign matter into the conduit system by properly capping terminations.
- O. Avoid trapped runs of conduit, if possible. When they are necessary, provide drainage using a "tee" conduit equipped with a drain. Conduit is likely to pass through areas with a temperature differential of 20 degrees F or more. Seal penetrations with a proper seal fitting at the wall or barrier between such areas. For conduit passing through walls separating pressurized areas from non-pressurized areas, install sealing fittings at the wall on the non-pressurized side.
- P. Fit conduit crossing building or structure expansion joints with approved expansion fittings, except that fittings will not be required when conduit crossing an expansion joint is supported on trapeze hangers in such a way that at no time will the conduit be under stress due to expansion. Install bonding jumpers around expansion joint fittings.

- Q. Where conduit terminates in sheet metal enclosures, threaded hubs are required. Conduit entries with double locknuts and bushings are prohibited. Sheet metal enclosures located outside or in any other wet, damp, or corrosive areas shall be furnished with threaded hubs. Restrict side penetrations to the lower one third of the enclosure.
- R. Provide liquid tight flexible metallic conduit only where necessary to allow for movement or to localize sound or vibration, at transformers, at motors, solenoid valves, motor operated valves, generators, and any other rotating equipment unless shown otherwise on Drawings. Limit length to less than 2 feet. Do not make rigid connections of conduit to vibrating equipment housing or frame. Do not use flexible metallic conduit for light fixture circuits or similar devices and do not use as a substitute for rigid conduit.
- S. Seal openings or holes where conduits pass through walls or floors. When conduits are passing through a firewall or fire-rated floor into different rooms, cabinets, or enclosures, use a fire-rated seal as shown in the typical detail included in the Drawings. Certain walls, where indicated on the Drawings, require environmental (airtight) seals; seal as shown.
- T. Install explosion-proof seals in conduit runs crossing or entering a hazardous classified area, where shown on Drawings. Install type CSBE removable sealing fittings to seal pump cables in the wet well and at the first junction box outside the well. Install EYS seals in all conduits leaving chemical rooms or chemical storage spaces. There shall be no unions, couplings, boxes, or fittings in conduit run between seal and point at which conduit leaves the room.
- U. Unless otherwise indicated on the Drawings, install expansion fittings every 300 feet within a straight conduit run and where conduit crosses building expansion joints, using bonding straps to ensure ground continuity.
- V. Parallel runs of conduit may be supported by structural steel racks. When two or more racks are arranged one above the other, provide vertical separation of not less than 12 inches between racks, unless otherwise indicated on the Drawings. Space conduits on the racks at least enough to provide 1/4 inch clearance between hubs on adjacent conduits at terminations and to allow room for fittings.
- W. Fill conduit racks no more than 75 percent of their capacity, providing usable space for future conduit. To ensure this, conduits leaving the rack horizontally shall be offset up or down so that future conduits may be installed in the space remaining.

- X. Construct conduit racks to permit access for wire or cable pulling at all pull points, even when future conduits are added to fill the racks.
- Y. Where conduit racks are supported on rods from beam clamps or by some other non-rigid suspension system, install rigid supports at no more than 50-foot intervals to give lateral stability to the rack.
- Z. Conduit racks or hangers must in no way interfere with machinery (or its operation), piping, structural members, process equipment, or access to anticipated future equipment. Refer to architectural, structural, equipment layout and piping drawings to ensure that this requirement is met.
- AA. Label high voltage conduit with the circuit phase-to-phase voltage by means of a firmly attached tag or label of approved design at each conduit termination, on each side of walls or barriers pierced and at intervals not exceeding 200 feet along the entire length of the conduit.
- BB. Support conduit sizes 2 inches and larger at spacings not exceeding 10 feet and conduit sizes 1-1/2 inches and smaller at spacings not exceeding 8 feet.
- CC. The means of fastening conduit to supports shall be: by one hole malleable iron conduit straps secured by wood screws to wood and by bolts with expansion anchors to concrete or masonry; by "Korn" clamps or U-bolts to other surfaces. Use "clamp backs" when strapping conduits to walls, column faces, or other such surfaces.
- DD. Support conduit runs with conduit clamps, hangers, straps, and metal framing channel attached to structural steel members. Conduits of 1-1/2 inch size or less may be supported by one-hole conduit straps on concrete, tile or steel work, but for larger size conduit, use 2-hole straps. Use clamps of galvanized malleable iron for rigid galvanized conduit and PVC-coated or stainless steel for PVC-coated conduit. Metal framing channel straps used for PVC-coated conduit shall be Type 316 stainless steel.
- EE. Install conduits supported from building walls with at least 1/4-inch clearance from the wall to prevent the accumulation of dirt and moisture behind conduit. All conduits shall be routed below concrete floor slabs on grade and shall have sand fill and cover. Set depth to account for radius of turn-up to prevent exposure of elbow bend.

- FF. Where specifically shown on plans, size and space embedded conduits in structural slabs in accordance with the Uniform Building Code. Conduits should occupy no more than one-third the thickness of the slab and should not be closer than 3 times the largest diameter on center without additional reinforcement.
- GG. Do not cut paved driveways, sidewalks, concrete foundations, etc. to install conduits unless specifically noted on plans. Bore under such construction and maintain a minimum of 24 inches below underside of paving or concrete. Repair any cutting or damage to original condition and to satisfaction of Engineer and Owner.
- HH. All conduits for fiber optic cables are to have wide tube radius compatible with cable manufacturer's requirements. Install per NEC.
- II. Damaged conduits shall be replaced at no additional cost to Owner where Engineer deems necessary because of extent of damage or, where conductors are damaged by defective conduit installation.
- JJ. Seal all conduits entering motor control centers, control panels, equipment, enclosures, valve actuators, etc. with CSBE seals or, install EYS at locations permissible. Sealing glands shall be selected specifically for each conduit and conductor. Install seals at all equipment located at elevation lower than U.G. conduit route.
- KK. Conduits penetrating underground pull boxes shall be sealed with CSBE seals where larger than 1 ¼-inch diameter and with RTV silicon based sealant where smaller than 1 ¼-inch diameter.
- LL. Conduits penetrating structural walls of lower levels shall be sealed with CSBE seals where larger than 1 ¼-inch diameter and with RTV silicon based sealant where smaller than 1 ¼-inch diameter. Duct seal is not allowed.
- MM. All conduit duct banks penetrating lower level structures and penetrating underground pull boxes shall be sealed watertight between conduit and wall of structure or pull box.
- NN. Where conduits are stubbed out from building for future use, extend conduits 5 feet past building wall or past edge of pavement, whichever is applicable. Do not leave under pavement. Cap ends of conduits.

- OO. All conduits shown entering outside walls of buildings may stub-up immediately adjacent to wall and penetrate low on wall where specifically indicated on plans. Where not shown entering wall, all conduits shall be routed up through building floor by excavating below foundation, core drill through floor, and stub-up conduits then backfill with cement stabilized sand, compacted in place.
- PP. Apply a conductive coating to field-cut threads of aluminum conduits to ensure continuity and ease of joining. Noalox and Kopr-Shield are acceptable coatings.
- QQ. Avoid excessive force when tightening threaded fittings for aluminum conduit, both between conduits and at threaded box entries. Generally, the correct force is hand-tight plus one full turn with a wrench. At least three (3) full threads should be engaged.
- RR. Do not use conduit bushings to secure threaded aluminum RMC to a box or enclosure. Install a locknut between a conduit bushing and the inside of the box or enclosure.
- SS. Threadless fittings shall not be used with threaded aluminum conduit.
- TT. Install expansion fittings in outdoor runs of aluminum RMC.
- UU. Do not install aluminum conduit in concrete or underground.
- VV. Use special tools for installing aluminum conduit. All damaged conduits shall be replaced.
- WW. In chemical rooms, enclosures, and portable/prefab buildings used for chemical storage or chemical equipment operation, use Schedule 80 PVC conduit and fittings only, except where specifically noted on Plans, use PVC coated steel conduit. Use PVC boxes and enclosures. There are no exceptions to this requirement unless specifically noted on drawings as an exception to this section.
- XX. Provide minimum one (1) additional spare 2 inch, two (2) spare 1 inch conduits from MCC to U.G. pull box and between all U.G. pull boxes on site.
- YY. Do not route conduit on outside walls of buildings or structures unless specifically shown on Plans, route from floor slab. Do not route conduit on building interiors, MCC rooms or equipment rooms unless shown on Plans, or approved in writing. Exception: conduits to light fixtures on ceilings. Paint to match. Where shown on Plans or where approved, conduits shall be painted to match surface on which installed. Submit drawings or sketches of any conduit routing that varies from Plans or Specifications.

- ZZ. Where underground conduit ductbanks are routed under new building slabs greater than 4 inches thick, conduits may be encased in cement stabilized sand with red marking tape.
- AAA. Provide steel conduit for all security, fire, TV, and access control system circuits. Coordinate circuits and conduit requirements within respective vendors.
- BBB. Paint all exposed conduit threads to prevent corrosion. Match color of conduit.
- CCC. Paint all exposed rigid steel surface mounted conduits in MCC rooms. Match wall and ceiling color.
- DDD. Do not route conduits across slabs. Route below slab and turn up at proper location. For existing structures, evacuate beneath slab, core drill for conduit penetration up to equipment and back fill execution with cement-stabilized sand. See details on plans for installation methods. Exception: where route across slab is less than 6 inches, exposed conduit is acceptable.
- EEE. Contact Engineer for inspection of conduit stub-ups and U.G. ductbanks before concrete pour.
- FFF. Where RGS conduit is installed on interior or exterior building walls (or ceilings), paint conduit, supports and clamps to match wall color.
- GGG. For conduits that will contain coaxial cable or other wide radius band cables, provide wide sweep conduit elbows on bands that will accommodate pulling such cables thru 3 90 degree turns without exceeding band radius limitations.

END OF SECTION

SECTION 16120
600 VOLT BUILDING WIRE AND CABLE

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - "Electrical Work" for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SECTION INCLUDES

- A. Specifications for 600-volt building wire and cable.
- B. Specifications for VFD cable.

1.02 REFERENCES

- A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA 70 - National Electrical Code (NEC):
 - 1. Article 310 - Conductors for General Wiring.
 - 2. Article 200 – Use and Identification of Grounded Conductors.
- B. Underwriter's Laboratories (UL)
 - 1. UL 83: Thermoplastic Insulated Wires and Cables
 - 2. UL 1063: Machine Tool Wires and Cables
- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM B3: Soft or Annealed Copper Wires
 - 2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft
- D. Insulated Cable Engineers Association (ICEA), ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).

1.03 SUBMITTALS

- A. Submit the following for Engineer's approval.
 - 1. Manufacturer's cut sheets and catalog data
 - 2. Instruction for handling and storage
 - 3. Dimensions and weight
- B. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 QUALITY ASSURANCE

- A. Tests. Cable shall meet all the requirements of Part 6 of ICEA S-61-402.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ship wire and cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 PRODUCTS

2.00 ACCEPTABLE MANUFACTURERS

- A. Cerro
- B. Southwire
- C. Service Wire Company

2.01 MATERIALS AND EQUIPMENT

- A. Design. Provide cable designated as THWN/THHN or XHHW single conductor type and UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90° C in dry locations and 75° C in wet locations while installed in underground duct, conduit or in control panels (MTW). Use XHHW, 90° rated conductors for main service or feeders.
- B. Conductors. Provide conductors, which are Class B, concentric stranded, annealed uncoated copper with physical and electrical properties complying with ASTM B3 and B8 and Part 2 of ICEA S-61-402.
- C. Insulation. Each conductor shall be PVC insulated and nylon jacketed to meet the requirements of Part 3 of ICEA S-61-402. The insulation thickness shall match the dimensions listed in NEC Table 310-13 for type THHN and THWN wire.
- D. Wire Marking
 - 1. Wire marking shall be in accordance with NEC Article 310-11 and shall be printed on the wire insulation at 2-foot intervals.
 - 2. The printing method used shall be permanent and the color shall sharply contrast with the jacket color.
- E. The single conductor color coding shall be as follows:

<u>System Voltage</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Neutral</u>
120/240 Volt 1Ph/3w	Black	Red		White
120/208 Volt 3Ph/4w	Black	Red	Blue	White
120/240 Volt 3Ph/4w	Black	Orange	Blue	White
277/480 Volt 3Ph/4w	Brown	Purple	Yellow	Grey
Motor Control	1	Black		
	2	Red		
	3	Blue		
Ground	Green			

2.02 VFD cables are to be selected and provided for AC motor drive duty and shall be rated at voltage listed in VFD Manufacturer's data sheets.

2.03 All service and feeder conductors to be XHHW-2.

PART 3 EXECUTION

3.00 PREPARATION

- A. Complete the cable raceway systems and underground duct banks before installing cables.
- B. Verify sizing of raceways and pull boxes to ensure proper accommodation for the cables.
- C. Check the length of the cable raceway system against the length of cable on the selected reel.
- D. Clean conduits of foreign matter before cables are pulled.

3.01 INSTALLATION

A. Wiring Methods

- 1. Use wiring methods indicated on the Drawings
- 2. In general, use THHN/THWN or XHHW building wire for lighting, power and control wiring where conductors are enclosed in raceways such as above ground conduit system, underground duct banks, or inside control panels. Use XHHW, 90° rated conductors for main service or power and motor feeders.
- 3. Do not use solid conductors.
- 4. Use conductors no smaller than No. 12 AWG stranded for lighting circuits indoors and not smaller than No. 10 AWG stranded for outdoors. Use No. 10 AWG (minimum) for outdoor receptacles on structures or poles.
- 5. Use conductors no smaller than No. 14 AWG for control circuits, except when part of a multi-conductor cable or internal panel wiring.
- 6. In general, do not splice conductors. All conductors must be one continuous length from starting point to end point without splices, unless prior written approval by Engineer.
- 7. Splices associated with taps for lighting and control circuits are allowed without approval.
- 8. Make splices in accessible junction boxes located above ground. Do not splice power and control conductors in underground pull boxes or manholes, unless specifically allowed. Any splices allowed in underground boxes shall be made using 3M water tight kits specifically made to withstand submergence in water.

Any conductors allowed to be spliced in underground boxes shall have conductors elevated to near top of wall.

9. Wire nuts with insulated caps may be used for lighting wiring splices located in wall boxes, switch boxes, and receptacle boxes, but not in control panels, MCC's or underground boxes. Splice control circuit with insulated crimp connectors.
 10. All conductors routed in manholes, electrical vaults and underground pull boxes shall be routed around walls and supported by nonmetallic fiberglass unistrut that is bolted vertically to walls at intervals not less than two per wall. Do not use horizontal arms unless specifically called for. Support conductors with stainless steel bands made for the purpose of supporting conductors, or with large wide nylon Ty-Wraps. Under no conditions shall conductors be routed directly across length of box. Any conductors routed otherwise shall be removed and replaced at Contractors expense. Splicing in UG pull boxes, manholes or vaults is prohibited without written approval by Engineer.
- B. Single Conductor in Conduit and Ductbank
1. Install cables in accordance with the manufacturer's instructions and NEC Chapter 3 - Wiring Methods and Materials. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.
 2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.
 3. Splices are not allowed in manholes.
- C. Single Conductor in Cable Tray: Do not install single conductor building wire and cable in cable tray. All conductors to be tray rated composite cable type.
- D. Multi-Conductor Shielded VFD Rated Cable:
1. Install cables in accordance with the manufacturer's instructions.
 2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.
 3. Do not splice cables unless specifically shown on plans. Provide as one continuous length. Where splicing is shown on plans or approved, use mechanical compressing tools and splice barrels only, and tape connections.

4. All cables and conductors routed thru UG pull boxes or manholes shall be routed around walls and secured on racks. See plans for details.
- E. Preparation for Termination
1. Make 600-volt power cable terminations and splices with heat shrinkable sleeves and seals.
 2. Terminal lugs and connectors for all sizes of conductors shall be crimp-on type.
 3. For size 1/0 AWG and larger, crimp-on lugs shall have the long barrel with 2-hole tongues except in places where termination space is limited.
- F. Tests:
1. In general, test insulation integrity of the wiring system before terminating.
 2. Make sure to disconnect sensitive electronic equipment before testing insulation.
 3. Use a 500 VDC megohmmeter and perform the wire system insulation test in accordance with the operating instructions.
- G. Termination: After the 600-volt wiring system has been tested with satisfactory results, reconnect wire.
- H. Inspection of Conductors
- I. All conductors shall be inspected for damage after pulled in conduit. Where damage is deemed excessive by Engineer, conductors shall be replaced for entire length of run.
- J. Where damage is due to condition of conduits, Contractor may be requested to provide a televised inspection of conduits at no additional cost to Owner and where deemed necessary by Engineer, any damaged conduits shall be replaced at no additional cost to Owner.

END OF SECTION

SECTION 16126
INSTRUMENTATION CABLE

PART 1 GENERAL

1.00 CONDITIONS

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- B. Refer to Section 16012 – “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SECTION INCLUDES

- A. Specifications for instrumentation cable.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM B3: Soft or Annealed Copper Wires.
 - 2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
 - 3. ASTM B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- B. Institute of Electrical and Electronics Engineers (IEEE), IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.
- C. Insulated Cable Engineers Association (ICEA).
 - 1. ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).
 - 2. ICEA S-66-524: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-7).
 - 3. ICEA S-68-516: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8).

- D. Underwriters' Laboratories (UL).
 - 1. UL 44: Rubber Insulated Wires and Cables.
 - 2. UL 83: Thermoplastic Insulated Wire and Cables.
- E. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA No. 70 - National Electrical Code (NEC), Chapter No. 3 - Wiring Methods and Materials, Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits.

1.03 SUBMITTALS

- A. Submit all products covered under this Section for Engineers approval.
 - 1. Completed engineer's data sheets from this specification or manufacturer's data sheets, cut sheets, and catalog data.
 - 2. Installation, terminating and splicing procedure (including bending radius and pulling tension data).
 - 3. Instruction for handling and storage.
 - 4. Dimensions and weight.
- B. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 QUALITY ASSURANCE

- A. Tests
 - 1. Cable shall be tested at the factory to confirm that the cable complies with requirements of ICEA Section 7.7.9 of S-66-524 or 7.5.9 of S-68-516.
 - 2. Where applicable, the cable shall meet the requirements of the vertical tray flame test as described in IEEE 383-2.5.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ship cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Alpha Wire Corporation
- B. Belden Division, Cooper Industries, Inc.
- C. Cablec Continental Cables Company
- D. General Cable Company
- E. Manhattan Electric Cable Corporation
- F. Okonite Company

2.02 MATERIALS AND EQUIPMENT

- A. Design. Provide cable with the following design characteristics. The cable shall consist of multiple conductors. The cable assembly shall be UL listed, flame, oil, and sunlight resistant, and certified for continuous operation at the temperature specified in wet or dry locations while installed in underground duct, conduit, or cable tray. The number and size of conductors supplied in each cable shall correspond to the quantities specified. Each conductor shall be individually insulated. Pairs and triads shall have conductors, which are twisted together with a drain wire, shielded, and covered with a jacket. Multi-pair/triad cables shall consist of the required number of electrically isolated, shielded pairs or triads, which are bundled together and covered by an overall jacket as specified. **Provide composite multi-conductor, shielded pair or triad, outer sheathed cables where shown on plans.**
- B. Conductors. Provide conductors, which are Class B, concentric stranded, annealed tinned copper whose physical and electrical properties comply with ASTM B3, B8 or B33 and Part 2 of ICEA S-61-402, S-66-524, or S-68-516, unless otherwise specified.

- C. Insulation. Each conductor shall be insulated as specified in compliance the requirements of Part 3 of ICEA S-61-402, S-66-524, or S-68-516. The average insulation thickness shall not be less than the dimensions shown in Table 7-32 or 7.5.1 of ICEA S-66-524 or S-68-516 for 600-volt insulation unless otherwise specified. The minimum insulation thickness shall not be less than 90 percent of the value given in the table.
- D. Drain Wire. Provide drain wire which is Class B, seven-stranded, tin-coated copper in accordance with ASTM B3, B8, or B33 and as specified. The drain wire shall not be less than two AWG sizes smaller than the insulated conductor's size, except for multiple pair triad drain wires, which shall not be less than the insulated conductor size.
- E. Shielding. Provide shielding consisting of laminated, non-burning, mylar-backed aluminum tape applied helically around a twisted pair or triad with the aluminum side in continuous contact with the drain wire unless otherwise specified. Wrap the tape around each twisted pair or triad with a 25 percent minimum overlap unless otherwise specified.
- F. Jacket. The physical and electrical properties of the jacket used to cover single or multi-pair or triad cables shall meet the requirements of section 7.7.7 or ICEA S-66-524 or section 7.5.6 of ICEA S-68-516. Jacket material as specified. The jacket thickness shall be equal to the dimensions shown in Table 7-33 or 7.5.2 of ICEA S-66-524 or S-68-516.
- G. Armor. Where requested, use instrumentation cables protected by an interlocked metal tape armor coating made of galvanized steel, which meets the requirements of paragraph 4.5 of ICEA S-68-516 or S-66-524, unless otherwise specified.
- H. Conductor Identification. Use individual conductors in single-pair and single-triad cables, which are, color coded black and white; and black, white and red, respectively. Multi-pair-triad cables shall have one conductor in each pair or triad colored white, and all other conductors are color coded in sequence according to Table L-2 of Appendix 2 of ICEA S-66-524, and as specified.
- I. Cable Marking. Print cable marking information on the jacket of each cable at 2-foot intervals. Use a permanent printing method with color sharply contrasting the jacket color.

PART 3 EXECUTION

3.01 PREPARATION

- A. Complete cable raceway systems, underground duct banks, and cable support systems before installing cables.

- B. Verify sizing of raceways and pull boxes to ensure proper accommodation for the cables.
- C. Check the length of the cable raceway system against the length of cable on the selected reel.
- D. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.
- E. Clean conduits of foreign matter before cables are pulled.
- F. Provide at least 30 percent spare conductors or pairs.

3.02 INSTALLATION

A. Cable in Conduit and Ductbank

1. Install cables in accordance with the manufacturer's instructions and NEC Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling and Power Limited Circuits. Do not exceed maximum wire tension, maximum insulation pressure, and minimum bending radius.
2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation or cable jacket.
3. Conduits carrying low level signal cables shall be PVC-coated rigid steel.

B. Cable in Tray. Install instrument and signal cable in cable tray only when the tray is dedicated for this type cable and cables are approved for tray installation.

C. Termination

1. Do not splice conductors. For termination use crimp-on type ring tongue non-insulated tin plated copper lugs.
2. For shielded control cable, terminate the shield and ground it at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables.
3. If splicing is required, maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes, or other splice points. Insulate these points from ground.

4. Mark wiring on both ends with circuit numbers or loop tag numbers. Heat shrink wire markers after the ring tongue terminal has been installed. Extend the marker over the crimp or base of the terminal.
- D. Tests
1. Before connecting the cables, test insulation integrity and conductor continuity.
 2. Use a 500 VDC megohmmeter and perform the cable insulation test in accordance with the operating instructions.
- E. Termination. After the cable has been tested with satisfactory results, the cable can be terminated at both ends to their designated terminal points.

END OF SECTION

SECTION 16131
DEVICE, PULL AND JUNCTION BOXES

PART 1 GENERAL

1.00 CONDITIONS

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- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SECTION INCLUDES

- A. Specifications for device, pull, and junction boxes.

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA).
 - 1. FB1 - Fittings and Support for Conduits and Cable Assemblies
 - 2. 250 - Enclosures for Electrical Equipment (1000 volts maximum)
- B. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA70 - National Electrical Code (NEC) - Article 314 - Outlet Device, Pull and Junction Boxes, Conduit Bodies and Fittings.
- C. Underwriters Laboratories (UL):
 - 1. 50 - Safety Cabinets and Boxes
 - 2. 508 - Safety Industrial Control Equipment
 - 3. 514B - Safety Fittings for Conduit and Outlet Boxes
 - 4. 886 - Safety Outlet Boxes and Fittings for Use in Hazardous Areas.

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval.
 - 1. Manufacturer's cut sheets, catalog data
 - 2. Instruction for handling and storage
 - 3. Installation instructions
 - 4. Dimensions and weights
- B. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Pack and crate boxes to permit ease of handling and to provide protection from damage during shipping, handling, and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Sheet Metal Boxes
 - 1. Hoffman Industrial Products
 - 2. Pauluhn Electric Manufacturing Company
 - 3. Hennessy
 - 4. Tanco
 - 5. Tejas
 - 6. Circle A.W.
- B. Cast Device Boxes
 - 1. Appleton Electric Company

2. Crouse-Hinds, Division of Cooper Industries
3. Killark Electric Manufacturing Company

2.02 MATERIALS AND EQUIPMENT

A. Sheet Metal Boxes

1. Provide UL-approved junction boxes and pull boxes manufactured from stainless steel sheet metal and meeting requirements of NEMA 4X for corrosive and wet areas, NEMA 250 and NEC Article 314. Enclosures located outdoors or in environmentally harsh or wet locations shall be NEMA 4X 316 stainless steel.
2. Provide boxes with a stainless steel continuous hinge, closure hasps and all-stainless steel hardware.
3. Furnish the door with neoprene gasket and provision for padlock.

B. Device Boxes:

1. Provide UL-approved boxes designed and manufactured to house electrical devices like receptacles and switches, and in conformance with NEMA FB1 and NEC Article 314.
2. Supply boxes that are hot-dip galvanized on cast iron suitable for corrosive and wet atmosphere.
3. All boxes located in environmentally harsh or wet or outdoor locations shall be NEMA 4X 316 stainless steel.
4. All boxes located in chemical rooms shall be H.D. PVC only.
5. Where unprotected service conductors are routed through a pull box with other conductors a divider wall shall be provided in the pull box for separation as required by the NEC.

C. Hardware

1. Mounting Hardware: Stainless steel
2. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Review the drawings and determine how many boxes of each kind are required and check if supplied quantity is sufficient.

3.02 INSTALLATION

- A. Boxes described in this specification shall be used both in dry and wet, corrosive areas, both inside and outside locations.
- B. Install boxes in accordance with NEC Article 314 in locations indicated on the Drawings.
- C. Install junction and pull boxes in readily accessible places to facilitate wire pulls, maintenance, and repair.
- D. Plug unused conduit openings.
- E. Make conduit connections to sheet metal boxes with watertight conduit connectors.
- F. Size underground pull boxes and manholes large enough to allow cables and conductors to be routed around walls and supported on wall racks. See plans for details. Do not use arms on mounted racks, except for MV cables or large multiple 600 Volt cables. Do not cross and occupy middle of pull box or manhole with cables or conductors.

END OF SECTION

SECTION 16135
CABINETS, BOXES AND FITTINGS

PART 1 GENERAL

1.00 CONDITIONS

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- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SUMMARY

- A. Section Includes:
 - 1. Outlet and device boxes.
 - 2. Pull and junction boxes.
 - 3. Floor boxes and service fittings.
 - 4. Cabinets.
 - 5. Hinged door enclosures.
 - 6. Boxes and fittings for hazardous locations.
- B. Conduit-body-type electrical enclosures and wiring fittings are specified in Section 16111 – “Conduit, Fittings, and Bodies.”

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM): ASTM A167-91 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. Underwriter's Laboratory (UL):
 - 1. UL 50 - UL Standard for Safety Cabinets and Boxes.
 - 2. UL 514A - UL Standard for Safety Metallic Outlet Boxes.

3. UL 514B - UL Standard for Safety Fittings for Conduit and Outlet Boxes.
 4. UL 886 - UL Standard for Safety Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
- C. National Electrical Manufacturer's Association (NEMA):
1. NEMA ICS 6 - Enclosures for Industrial Control and Systems.
 2. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 3. NEMA 250 - Enclosure for Electrical Equipment (1,000V maximum).

1.03 DEFINITIONS

- A. Cabinets: Enclosure designed either for surface or for flush mounting and having frame or trim in which door or doors may be mounted.
- B. Device Box: Outlet box designed to house receptacle device or wiring box designed to house switch.
- C. Enclosure: Box, case, cabinet, or housing for electrical wiring or components.
- D. Hinged Door Enclosure: Enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with walls of box.
- E. Outlet Box: Wiring enclosure where current is taken from wiring system to supply utilization equipment.
- F. Wiring Box: Enclosure designed to provide access to wiring systems or for mounting of indicating devices or of switches for controlling electrical circuits.

1.04 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval.
- B. Product Data: Submit for cabinets and enclosures with classification higher than NEMA 1.
- C. Shop Drawings: Submit to Engineer for approval.

- D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.05 QUALITY ASSURANCE

- A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code: Components and installation shall comply with NFPA 70.

PART 2 PRODUCTS

2.01 CABINETS, BOXES, AND FITTINGS, GENERAL

- A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for use and location. Provide items complete with covers and accessories required for intended use. Provide gaskets for units in damp or wet locations.
- B. Cabinet and Enclosures Heights: Cabinet, panel, and enclosure heights shall not exceed 6 feet – 6 inches from floor to top fastening devices to allow access by Operator without use of ladders or steps to open enclosure doors.

2.02 MISCELLANEOUS MATERIALS AND FINISHES

- A. Fasteners for General Use: Stainless steel screws and hardware.
- B. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
- C. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings, and box connectors.

D. Finishes:

1. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
2. Interior Finish: Where indicated, white baked enamel.

2.03 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

A. General:

1. Conform to UL 514A and UL 514B.
2. Boxes shall be of type, shape, size, and depth to suit each location and application.

B. Steel Boxes: Conform to NEMA OS 1. Boxes shall be sheet steel with stamped knockouts, threaded screw holes, and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.

C. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

2.04 PULL AND JUNCTION BOXES

A. General: Comply with UL 50 for boxes over 100 cu in. volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

B. Galvanized Steel Boxes: Flat rolled, code gauge, sheet steel with welded seams. Where necessary to provide rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

C. Stainless-Steel Boxes: Fabricate of 316 stainless steel conforming to ASTM A167. Where necessary to provide rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.

D. Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

- E. Boxes Approved for Classified Locations: Cast metal or cast nonmetallic boxes conforming to UL 886 listed and labeled for use in specific location classification, and with specific hazardous material encountered. Conduit entrances shall be integral threaded type.

2.05 CABINETS

A. Acceptable Manufacturers

1. Hennessey Products, Inc.
2. Hoffman Engineering
3. The EMF Company
4. Rose Enclosure
5. Weigman Company
6. NEMA Enclosure Manufacturing Company

B. Indoor Control Cabinets

1. Enclosure: NEMA 250, Type 12 unless shown otherwise on plans.
2. Enclosure Size: As indicated on Drawings or, if not indicated, as required to mount equipment indicated to UL Standards.
3. Backboard for Mounting Terminal Blocks, Components, and Inner Door: 12 gauge steel, finished in white enamel.
4. Fronts: Steel pan-type doors with concealed stainless steel piano hinges, held closed by stainless steel 3-point latch operable by pistol grip handle.
5. Provide solid metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.
6. Clean surfaces to remove dirt and corrosion residue. Phosphatize for corrosion protection. Prime with two coats, and finish with one coat, of factory-applied textured polyurethane, minimum 5 mils thickness, color as selected by City Engineer from manufacturer's standard colors.
7. Panel Construction: Provide panel stiffeners and bracing. Fully gasket doors. Weld seams and grind smooth.

8. Conduit Entrances: Bottom entry unless otherwise indicated on Drawings.
9. Material: Minimum 12 gauge steel.
10. Finish: Enamel; gray outside, white inside.
11. Provide thermostat controlled strip-type space heater (150 watts maximum), convenience outlets and internal fluorescent lighting (where shown on drawings.)
12. Nameplates: On the outside of each cabinet's inner door, provide motor data nameplate information for each pump motor; copy all information exactly as shown on each motor nameplate. Provide engraved laminated plastic nameplates; black letters with white background; fasten to outside of cabinet door of each motor starter section with stainless steel screws.
13. Install wiring in open-slot plastic wiring duct.
14. On indoor panels, install a 4-inch passive vent in the side near the top and near the bottom of an adjacent side panel. These vents shall have removable filters to resist dust and insect entry.

C. Outdoor Control Cabinets

1. Enclosures: NEMA 4X 316 stainless steel.
2. Enclosure Size: As indicated on Drawings, or if not indicated, as required to accommodate equipment and as indicated in UL standards.
3. Material: Exterior and interior enclosure doors, shelves and component enclosures: Fabricate of 14 gauge type 316 stainless steel.
4. Doors: Stainless steel pan-type construction, with full-length stainless steel piano hinge (for stainless steel or aluminum). Equip exterior door with locking hasp, padlock, heavy-duty locking pistol-grip handles, door restraint and 3-point latching mechanism of the draw roller type (0.750 inch minimum diameter rollers). Handles shall be 3/4 inch minimum diameter stainless steel. Equip interior doors with flush quarter-turn closure devices. Equip interior and exterior doors with neoprene gaskets. Provide restraints on all outer doors.
5. Space Heaters: Provide minimum 150 watt strip-type space heaters with an individual thermostat in each section. Use heaters rated for 240V, producing the required wattage when operated at 120V.

6. Provide rain shield with 1 inch drip lip for outdoor cabinets to protect against direct sun radiation and rainfall. Design shield to provide 1 foot of cover front and back and 2 inches of cover on the sides. Design shield to provide no more than 1 foot peak height above the top of the panel with 1 inch airflow clearance from the top of the control panel. Shielding material: Type 316 stainless steel.
 7. Nameplates: On the outside of each cabinet's inner door, provide motor data nameplate information for each pump motor; copy all information exactly as shown on each motor nameplate. Provide engraved laminated plastic nameplates; black letters with white background; fasten to outside of cabinet door of each motor starter section with stainless steel screws.
 8. In each cabinet section, provide a 120V convenience outlet and a switched 40 watt minimum fluorescent light fixture, with 0 degrees F ballast in each section (where shown on plans.)
 9. Inside and outside of cabinet shall be smooth and free from burrs.
 10. NEMA 4X enclosures shall have all boltholes gasketed.
 11. A divider of same material and thickness as the cabinet shall be added to divide electrical components and wiring from instrumentation and pneumatic components and wiring.
 12. No control devices are allowed on outer door of outdoor enclosures.
- D. Clear plastic outer or inner doors are not acceptable unless specifically noted on plans.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
- B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- C. Sizes shall be adequate to meet current NEC volume requirements, but in no case smaller than sizes indicated.
- D. Remove sharp edges where they may come in contact with wiring or personnel.

3.02 APPLICATIONS

- A. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types for each location in conformance with following requirements unless otherwise noted:
1. Interior Dry Locations: Sheet steel, NEMA type 1 for flush mounting and feraloy Type FS or FD cast boxes with threaded conduit hubs for surface mounting.
 2. Locations Exposed to Weather or Dampness: Galvanized, cast metal, NEMA Type 3R.
 3. Wet Locations: 316 Stainless Steel, NEMA type 4X enclosures.
 4. Corrosive Locations: 316 Stainless Steel, NEMA type 4X enclosures.
 5. Hazardous (Classified) Locations: NEMA type listed and labeled for location and class of hazard indicated.
- B. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location.

3.03 INSTALLATION OF OUTLET BOXES

- A. Gasketed Boxes: At following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:
1. Exterior locations.
 2. Where exposed to moisture laden atmosphere.
 3. Where indicated.
- B. Mounting: Mount outlet boxes for switches with long axis vertical or as indicated. Mount boxes for receptacles vertically. Gang boxes shall be mounted with long axis horizontal.
- C. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.
- D. Set boxes in concealed conduit runs, flush with wall surfaces, with or without covers as required.
- E. Set outlet boxes parallel to construction, securely mounted and adjusted to set true and flush with finished surface.

- F. Provide outlet box divider barriers between 277/480 v and 120/240 v devices as required and per current NEC.

3.04 OUTLET BOX LOCATIONS

- A. Locate flush mounted wall boxes in corner of nearest brick or block to keep cutting to minimum.
- B. Location of outlets and equipment as shown on Drawings is approximate and exact location to be verified and shall be determined by:
 - 1. Construction or code requirements.
 - 2. Conflict with equipment or other trades.
 - 3. Equipment manufacturer's drawings.
- C. Minor modification in location of outlets and equipment considered incidental up to distance of 10 ft with no additional compensation, provided necessary instructions given prior to roughing in of outlet.
- D. Mounting heights for devices and equipment to be measured from finished floor to centerline of device unless otherwise noted on Drawings.

3.05 INSTALLATION OF PULL AND JUNCTION BOXES

- A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-in. square by 4-in. deep. Do not exceed six (6) entering and six (6) leaving raceways in single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed following:

Size of Largest Conductors in Box	Maximum No. of Conductors in Box
No. 4/0 AWG	30
250 MCM	20
500 MCM	15
Over 500 MCM	10

1. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 in. inside boxes.
2. Size: Provide pull and junction boxes for telephone, signal, instrumentation, control, and other systems at least 50% larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.06 GROUNDING

- A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes grounding conductor, provide grounding terminal in interior of cabinet, box, or enclosure.
- B. Ground in accordance with Section 16452 – “Grounding.”

3.07 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions, and weld marks.
- B. Galvanized Finish: Repair damage using zinc-rich paint recommended by manufacturer.
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.00 CONDITIONS

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- B. Refer to Section 16012 – “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SECTION INCLUDES

- A. Specifications for wiring devices including:
 - 1. Receptacles.
 - 2. Wall switches.
 - 3. Wall plates and cover plates.

1.02 REFERENCES

- A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):
 - 1. NEMA WD1 - General Purpose Wiring Devices.
 - 2. NEMA WD6 - Dimensional Requirements.
- B. Federal Specifications (WC-596F).
- C. American National Standards Institute/National Fire Protection Association (NFPA):
 - 1. NFPA No. 70 - National Electrical Code (NEC), Articles 210 Branch Circuits, 250 Grounding and 406 Receptacles, Cord Connectors, and Attachment Plugs (Caps).

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval:
 - 1. Manufacturer's product literature and specifications including dimensions, weights, certifications, and instructions for handling, storage, and installation.
- B. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Pack and crate devices to permit ease of handling and protect from damage during shipping, handling, and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bryant Electric
- B. Crouse-Hinds, Arrow Hart Division
- C. Hubbell Inc. Wiring Devices Division
- D. Leviton Manufacturing Company
- E. Pass & Seymour/Legrand.

2.02 MATERIALS AND EQUIPMENT

- A. Standards: Conform to NEMA WD1 for general requirements and NEMA WD6 for dimensional requirements.
- B. Manufacture devices to heavy-duty industrial specification grade with ivory nylon bodies (orange for isolated-ground receptacles) back and side wiring provisions and green-colored grounding screws.
- C. Receptacles:
 - 1. Duplex-type receptacles: Rated 20 amps at 120 volts.

2. Contacts: Brass or phosphor bronze.
 3. Receptacle grounding system: Extend to the mounting strap unless isolated ground is indicated or required.
 4. GFI or GFCI (ground fault circuit interrupter) receptacles: Provide feed-through type with test and reset button. Use individual GFI receptacle at each location. Do not daisy chain unless specifically allowed.
- D. Wall Switches:
1. Toggle switches: Rated 20 amps at 120/277 volts AC rated for both resistive and inductive loads.
 2. Contacts: Silver cadmium oxide construction to prevent sticking, welding and excessive pitting.
- E. Cover Plates:
1. In outdoor, corrosive, and wet areas, provide cover plates of cast metal, gasketed with spring-loaded hinged covers and stainless steel hardware.
 2. All other plates: Type 302 stainless steel.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that device boxes are correctly placed.
- B. Verify that the correct quantity, size, and type of wires are pulled to each device box.
- C. Verify that wiring has been checked at both ends.
- D. Prepare wire ends for connection to devices.
- E. Inspect each wiring device for defects.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.

- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on top.
- E. Connect wiring device grounding terminal to outlet box with bonding jumper.
- F. Connect wiring devices by wrapping conductors clockwise around screw terminals.
- G. Install cover plates on switch, receptacle, and blank outlets in finished areas.
- H. Energize and test devices for proper operation.
- I. Use screw connections for wires. No push-in connections allowed.
- J. Only two (2) wires per screw terminal allowed. No conductor splices in receptacle box. Use separate box for splicing.
- K. Do not connect motor loads of any type to receptacle terminals.
- L. For water and wastewater plant equipment buildings, process buildings, MCC rooms, blower rooms, equipment structures, pump rooms, lift stations and other facilities, except office buildings and control rooms, install receptacles at 48 inches AFF. Install receptacles and light switches at ADA required heights.
- M. Install GFI receptacles for receptacles in wet areas, pump rooms and all outdoor locations. Provide W.P. covers.
- N. Do not daisy chain receptacle off of a single GFI receptacle; Use separate GFI receptacle at each location.

END OF SECTION

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.00 CONDITIONS

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- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SUMMARY

- A. Section Includes:
 - 1. Identification of electrical materials, equipment, and installations.
 - 2. Nameplate identification on MCC’s and control panels.
 - 3. Arc Flash Warning Signs
 - 4. Equipment and High Voltage Warning Signs
 - 5. Identification of conduit and conductors.

1.02 SUBMITTALS

- A. Submit all products covered under this specification for Engineer’s approval.
- B. Product Data: Submit for each type of product specified.
- C. Samples: Submit for each color, lettering style, and or graphic representation required for identification materials; samples of labels and signs.
- D. Miscellaneous: Schedule of identification nomenclature to be used for identification signs and labels.
- E. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code: Components and installation shall comply with NFPA 70.

B. Comply with ANSI C2.

PART 2 PRODUCTS

2.01 RACEWAY AND CABLE LABELS

- A. Manufacturer's Standard Products: Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.

- B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.

1. Color: Black legend on orange field.

2. Legend: Indicates voltage.

- C. Pre-tensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color coded, acrylic bands sized to suit diameter of line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.

1. Provide identification wire marker for all power and control conductors.

- D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 in. wide for phase and ground conductor identification.

- E. Underground Line Warning Tape: Permanent, bright colored, continuous printed, vinyl tape with following features:

1. Size: Not less than 6 in. wide by 4 mils thick.

2. Compounded for permanent direct burial service.

3. Embedded continuous metallic strip or core.

4. Printed Legend: Indicates type of underground line.

- F. Tape Markers: Vinyl or vinyl cloth, self adhesive, wraparound type with preprinted numbers and letters. Limited use for indoor control cabinets.
- G. Aluminum, Wraparound Marker Bands: Bands cut from 0.014 in. (0.4 mm) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
- I. Aluminum Faced Card Stock Tags: Wear resistant, 18 point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 in. (0.05 mm) thick, laminated with moisture resistant acrylic adhesive, and punched for fastener. Preprinted legends suit each application.
- J. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2 in. by 0.05 in. for conduit and power conductor identification. Attached with stainless steel bands.

2.02 ENGRAVED NAMEPLATES AND SIGNS

- A. Manufacturer's Standard Products: Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.
- B. Engraving stock, melamine plastic laminate, 1/16 in. (1.6 mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 in. (3.2 mm) thick for larger sizes.
 - 1. Engraved Legend: Black letters on white face.
 - 2. Punched for mechanical fasteners or stainless steel screws.
 - 3. Use in control panels, MCC's, device housings, boxes, and similar locations.
- C. Baked Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for application. 1/4 in. (6.4 mm) grommets in corners for mounting.
- D. Exterior, Metal Backed, Butyrate Signs: Wear resistant, non-fading, preprinted, cellulose acetate butyrate signs with 0.0396 in. (1 mm), galvanized steel backing, with colors, legend, and size appropriate to application. 1/4 in. (6.4 mm) grommets in corners for mounting.

- E. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or No. 10/32 stainless steel machine screws with nuts, flat washers and lock washers.
- F. Exterior, Painted Aluminum, Warning Signs: Wear resistant, non-fading, pre-printed aluminum with glossy finish with colors, and size appropriate to applications, ¼ inch grommets in corners for mounting. Provide per standards ANSI 2535 and OSHA 1910.145.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1 piece, self-locking, Type 6/6 nylon cable ties with following features:
 - 1. Minimum Width: 3/16 inch
 - 2. Tensile Strength: 50-pound minimum.
 - 3. Temperature Range: -40°F to 185°F.
 - 4. Color: As indicated where used for color coding.
- B. Paint: Alkyd-urethane enamel. Primer as recommended by enamel manufacturer.

2.04 MOTOR CONTROL CENTERS AND CONTROL PANELS

- A. Wire Markers: Provide wire markers on all power and wiring in MCC's and panels of all types. Identify wire at points of termination at devices and at terminal strips.
- B. Provide nameplates on body or housing of all pressure switches, transmitters, and other devices.
- C. Provide engraved nameplates near base of all relays and similar devices. Adhesive materials not allowed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install identification devices according to manufacturer's written instructions.
- B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and or designations used for electrical identification with corresponding designations used in Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Self-Adhesive Identification Products: Not allowed. Use stainless steel screws.
- F. Identify feeders over 600 V with "DANGER-HIGH VOLTAGE" in black letters 2 in. (51 mm) high, stenciled with paint at 10 ft (3 m) intervals over continuous, painted orange background. Identify following:
 - 1. Entire floor area directly above conduits running beneath and within 12 in. (305 mm) of basement or ground floor that is in contact with earth or is framed above un-excavated space.
 - 2. Wall surfaces directly external to conduits concealed within wall.
 - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
 - 4. Entire surface of exposed conduits.
- G. Install painted identification as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime Surfaces: For galvanized metal, use single component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy duty, acrylic resin block filler. For concrete surfaces, use clear, alkali resistant, alkyd binder type sealer.
 - 3. Apply one intermediate and one finish coat of silicone alkyd enamel.
 - 4. Apply primer and finish materials according to manufacturer's instructions.

- H. Identify Raceways and Exposed Cables of Certain Systems with Color Banding: Band exposed and accessible raceways of systems listed below for identification.
1. Bands: Pre-tensioned, snap around, colored plastic sleeves; colored adhesive tape; or combination of both. Make each color band 2 in. (51 mm) wide, completely encircling conduit, and place adjacent bands of 2 color markings in contact, side by side.
 2. Locate bands at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft (7.6 m) in congested areas.
 3. Colors: As follows:
 - a. Fire Alarm System: Red.
 - b. Fire Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunications System: Green and yellow.
- I. Install Caution Signs for Enclosures: Use label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover with stainless screws.
- J. Install Circuit Identification Labels on Boxes: Label externally as follows:
1. Exposed Boxes: Plastic label on cover.
 2. Concealed Boxes: Plasticized card stock tags.
 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- K. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 in. (150 to 200 mm) below finished grade. Where multiple lines installed in common trench or concrete envelope do not exceed an overall width of 16 in. (400 mm), use single line marker.

- 1. Install line marker for underground wiring, both direct buried and in raceway.
- L. Color Code Conductors: Secondary service, feeder, and branch circuit conductors throughout secondary electrical system.
 - 1. Field applied, color coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG.

- a. Colored, pressure sensitive plastic tape in half lapped turns for distance of 6 in. (150 mm) from terminal points and in boxes where splices or taps are made. Apply last 2 turns of tape with no tension to prevent possible unwinding. Use 1 in. (25 mm) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
- b. Colored cable ties applied in groups of three (3) ties of specified color to each wire at each terminal or splice point starting 3 in. (76 mm) from terminal and spaced 3 in. (76 mm) apart. Apply with special tool or pliers, tighten to snug fit, and cut off excess length.

<u>System Voltage</u>	<u>A.....</u>	<u>B.....</u>	<u>C.....</u>	<u>Neutral</u>
120/240 Volt 1Ph/3w	Black	Red	White
120/208 Volt 3Ph/4w	Black	Red	Blue	White
120/240 Volt 3Ph/4w	Black	Orange.....	Blue	White
277/480 Volt 3Ph/4w	Brown.....	Purple	Yellow.....	Grey
Motor Control	1.....	Black		
	2.....	Red		
	3.....	Blue		
Ground	Green		

- M. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.
 - 1. Legend: 1/4 in. (6.4 mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 - 2. Fasten tags with nylon cable ties; fasten bands using integral ears.

- N. Conduit Identification: Use aluminum tags with SS bands at termination points such as MCC, light fixtures, control panels, receptacles and junction boxes. Tag is to include conduit tag and panel circuit number (where applicable.).
- O. Apply identification to conductors as follows:
1. Conductors to Be Extended in Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
 3. Multiple Control and Communications Circuits in Same Enclosure: Identify each conductor by its system and circuit designation. Use consistent system of tags, color coding, or cable marking tape.
- P. Apply warning, caution, and instruction signs and stencils as follows:
1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
 2. Install warning signs on the following equipment as a minimum requirement.
 - a. MCC Main Breaker
 - b. Main Service Breaker
 - c. Transfer Switch
 - d. Where exposed bus bars inside.
 - e. Automatic Power Factor Correction Units
 - f. VFD's and Solidstate Starters
 - g. Other locations described in No. 1 above.
 3. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, and/or emergency operations.

Q. Install identification as follows:

1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal control, and alarm systems, unless units are specified with their own self-explanatory identification.

Except as otherwise indicated, provide single line of text with ½ inch high lettering on 1 ½ inch high label; where two (2) lines of text are required, use ½ inch lettering on 2 inch high label. For small control panels a smaller text may be used but shall be clearly readable. Use black lettering on white field. Use red lettering on white field where shown on plans or as requested by Engineer or Owner. Apply labels with stainless screws for each unit of following categories of equipment.

- a. Panelboards, electrical cabinets, and enclosures
- b. Access doors and panels for concealed electrical items
- c. Electrical switchgear and switchboards
- d. Electrical substations
- e. Motor control centers and control panels
- f. Motor starters
- g. Push button stations
- h. Power transfer equipment
- i. Contactors
- j. Remote controlled switches
- k. Dimmers
- l. Control devices
- m. Transformers
- n. Inverters
- o. Rectifiers

- p. Frequency converters
 - q. Battery racks
 - r. Power generating units
 - s. Telephone equipment
 - t. Conduits at manholes, at junction boxes, and pull boxes
2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
 3. For control panels the nameplate designation shall be according to the control, alarm or status function indicated on the control diagrams, one-line diagrams, details as required in other applicable specifications for this project.
 4. Provide nameplate designations list and nameplate and text size for Engineer and/or Owner's approval as required by 1.02 of this specification.

END OF SECTION

**SECTION 16290
LOW VOLTAGE SURGE PROTECTION DEVICE**

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Contractor shall contact local Factory Representative to verify all equipment conforms to the requirements of this project before purchase. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work”, Item 1.04 – “Submittals” for submittal requirements.
- D. All equipment installed on this project shall incorporate all devices and features to protect that equipment from the influence of other equipment, line voltage and phase irregularities, harmonics and other disturbances that may affect the proper and safe operation of that equipment whether these required features are a standard component of that equipment as an off-the-line product. No equipment shall be installed without these features. All surge protective devices shall be provided by same manufacturer.
- E. Contractor shall contact SPD manufacturer’s local representative before bidding to confirm model number supplied is proper for this project application.

1.01 SUMMARY REQUIREMENTS

- A. The Contractor shall furnish and install Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, or models specified as specified herein. The AC surge protection shall be integrated into each of the following items in this project: Electrical distribution equipment, Main breaker, switchgear, transfer switches, switchboards, panelboards, motor control centers, solid-state starters, VFD’s and local control panels, including equipment vendor control panels. This provision may not appear on all drawings, but is required unless specifically noted otherwise.

1.02 REFERENCE STANDARDS AND PUBLICATIONS

- A. General: The latest edition of the following standards and publications shall comply with the work of this section:

1. ANSI/IEEE C84.1, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)
2. ANSI/IEEE C62.41, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits
3. ANSI/IEEE C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
4. Underwriters Laboratories-UL 1449 Third Edition, Standard for Safety - Surge Protective Devices
5. Underwriters Laboratories-UL 1283, Standard for Safety - Electromagnetic Interference Filters
6. National Fire Protection Association, NFPA 70 - National Electrical Code
7. IEEE Standard 142, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
8. ANSI/IEEE Standard 141, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book)
9. IEEE Standard 1100, IEEE Recommended Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book)
10. National Electrical Manufacturer's Association, NEMA LS-1
11. MIL Standard 220B Method of Insertion-loss Measurement
12. ISO 9001, Quality Management Requirements

1.03 MANUFACTURER QUALIFICATIONS

- A. Eaton shall be the basis of design. All products submitted shall comply with, meet, or exceed the specifications of the Eaton model type specified herein. Equal products as pre-approved in writing by Engineer are acceptable.
- B. The manufacturer must be regularly engaged in the manufacture of surge suppression products for the specified categories for no less than 10 years.
- C. For the equipment specified herein, the Manufacturer shall be ISO 9001 or 9002 certified.

- D. The Manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of 5 years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- E. The surge protection device shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.04 WARRANTY

- A. Contractor shall provide full 10-year service warranty on the overall installation and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written "Final Acceptance" of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor's warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed. Where Manufacturer's products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its affect on the product. Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor's expense and at no additional cost to the Owner.
- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.
- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

- D. A surge protection device that shows evidence of failure or incorrect operation during the warranty period shall be replaced free of charge. Since “Acts of Nature” or similar statements typically include the threat of lightning to which the surge protection devices shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. The warranty shall cover the replacement of complete device. Surge protection devices with warranties that are meant to repair or supply replaceable parts shall not apply to this section

1.05 SUBMITTALS

- A. The SPD submittals shall include, but shall not be limited to, the following information:
1. Data for each suppressor type indicating conductor sizes, conductor types, and connection configuration and lead lengths.
 2. Manufacturer’s certified test data indicating the ability of the product to meet or exceed requirements of this specification.
 3. The SPD manufacturer’s local representative shall confirm, in writing, that the SPD model purchased is the proper selection for this project application as indicated on plans and specifications.
 4. List and detail all protection systems such as fuses, disconnecting means and protective materials.
 5. Surge protection device wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.
 6. If requested, a sample of each suppressor type shall be submitted for use in testing and evaluation.
 7. Provide verification that the surge protection device complies with the required ANSI/UL 1449, Third Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL’s website or on any other NRTL website, as long as the website contains the following information at a minimum: model number, surge protection device type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).

8. Provide Electrical drawings showing unit dimensions, weights, installation instruction details, lead length configuration, wiring configuration, and mounting arrangement of any optional remote diagnostic equipment and assemblies.
 9. Wiring diagram for each surge protector.
 10. MOV ratings.
- B. Provide submittals per Specification Section 16012 – “Electrical Work,” Item 1.04, for Engineer’s review and approval.
- C. The following information shall be submitted for record purposes:
1. Final As-Built drawings and information for items listed above and shall incorporate all changes made during the manufacturing process.
 2. Provide As-Built Drawings per Specification Section 16012- “Electrical Work,” Item 1.05.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Equipment shall be handled and stored in accordance with Manufacturer’s instructions. One (1) copy of Manufacturer’s instructions shall be included with the equipment at time of shipment.
- 1.07 OPERATION AND MAINTENANCE (O&M) MANUALS
- A. O&M manuals shall be provided with each surge protection device shipped per Specification Section 16012 “Electrical Work,” Item 1.05.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Cutler-Hammer
- B. Pre-approved equal

2.02 SYSTEM APPLICATION

- A. Only apply a wye (three-phase, four-wire) configured SPD if the neutral is physically connected to the SPD and properly installed per NEC. Confirm with manufacturer.

- B. Use a delta (three-phase, three-wire) configured SPD for any type of impedance (resistive, inductive) grounded system. Confirm with manufacturer.
- C. Use a delta (three-phase, three-wire) configured SPD for a solidly grounded wye system where the neutral wire is not pulled through to the SPD location. Confirm with manufacturer.
- D. Use a delta (three-phase, three-wire) configured SPD if the presence of a neutral wire is not known. Confirm with manufacturer.
- E. The surge protection device applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All surge protection devices shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- F. **Surge Protection Device Type: All surge protection devices installed on the line side of the service entrance disconnect shall be Type 1 surge protection devices. All surge protection devices installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 surge protection devices.**
- G. **Surge protection devices should not be installed on the load (at motor) of any variable frequency drive. Surge protection devices with EMI/RFI filters are not to be used on the load side (at motor) of soft starters.**

2.03 VOLTAGE SURGE SUPPRESSION – GENERAL

- A. Electrical Requirements:
 - 1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
 - 2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.
 - 3. Surge current per phase – 250 KA/phase for service entrance, 120 KA/phase for panelboards or other locations with 150 amps or more. Provide lower KA/phase ratings only where specifically shown on drawings, or recommended by manufacturer.

4. The suppression system shall incorporate self protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells or air gaps.
5. Protection Modes – The surge protection device must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (In) – All surge protection devices applied to the distribution system shall have a 20kA nominal discharge current rating regardless of their surge protection device type (includes Types 1 and 2) or operating voltage. Surge protection devices having a nominal discharge current less than 20kA shall be rejected.

B. Surge Protection Device Design:

1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable surge protection device modules shall not be accepted.

2. Electrical Noise Filter – Where specifically indicated on plans, unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted. Noise filter shall not be used for VFD driven motor applications.
3. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
4. Monitoring Diagnostics – Each surge protection device shall provide the following integral monitoring options:
 - a. Protection Status Indicators - Each unit shall have a green / red solid state indicator light that reports the status of the protection on each phase.

C. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes.

1. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
2. Overcurrent Protection: The unit shall contain self protected MOVs. These self protected MOVs shall have a self protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The self protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
3. Fully Integrated Component Design – All of the surge protection device components and diagnostics shall be contained within one discrete assembly. Surge protection devices or individual surge protection device modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

4. Safety Requirements:

- a. The surge protection device shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. Surge protection devices containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. Surge protection devices requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. Surge protection devices requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- b. Surge protection devices designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
- c. Side mount surge protection devices shall be factory sealed in order to prevent access to the inside of the unit. Side mount surge protection devices shall have factory-installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.04 ENCLOSURES

- A. All indoor enclosed equipment shall have NEMA 1 general-purpose enclosures, unless otherwise noted, otherwise provide enclosures suitable for locations as indicated in Specification Section 16012 – “Electrical Work,” Item 2.01, Paragraph C or on the drawings, and as described below:
 1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
 2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.

3. NEMA 4X – Constructed of 316 stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION/INSPECTION

- A. The Manufacturer shall submit a written statement indicating that a factory authorized representative has inspected the installation. The installing contractor shall submit a checkout memorandum to the manufacturers. The memorandum shall indicate the date the equipment is placed into service and the actual method of installation. Submit three copies to the specifying engineer.
- B. Inspection is to be performed prior to energizing SPD's.
- C. The installation of surge protection devices within or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment, and shall not damage equipment or SPD.
- D. SPDs shall use a separate path to building ground where specifically shown on plans; the equipment safety ground is not to be used as the primary transient voltage ground path.
- E. The installing contractor shall install the parallel surge protection device with short and straight conductors as practically possible.
- F. The contractor shall follow the Surge Protection Device Manufacturer's recommended installation practice as found in the equipment installation instructions, and as directed by the manufacturer and representative in writing.
- G. The installation shall adhere to all applicable codes.
- H. Route fail alarm circuits to autodialer and to PLC where shown on plans.
- I. The installing contractor of low-voltage lightning arresters shall be knowledgeable, and if required, certified, in all applicable electrical practices, standards, codes and wiring techniques as they pertain to installing surge suppressors.
- J. The installing contractor shall follow all applicable safety standards.
- K. The installing contractor shall follow manufacturer's installation instructions.

- L. The installing contractor shall mount surge protection device devices to keep phase neutral and ground conductor as short as possible and free of sharp bends in conductors. Phase conductors to be equal length. Installer shall make corrections to installation as directed by Engineer.
- M. Where SPD unit is installed at circuit breakers with adjustable GFI trip, contractor shall adjust trip setting at level that prevents false trips due to current flow to ground thru the SPD unit. Provide before and after trip setting values for Engineers review.

3.02 INSTALLATION REQUIREMENTS

- A. The surge protection device application covered under this section includes lighting, distribution panelboards, switchgear, switchboard, MCC and busway locations. The surge protection device units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B and C environments.
 - 1. The surge protection device shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 - 2. Surge protection devices shall be installed immediately following the load side of the main disconnect device. Surge protection devices installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
 - 3. The panelboard shall be capable of re-energizing upon removal of the surge protection device.
 - 4. The surge protection device shall be interfaced to the panelboard via a direct bus bar connection. Alternately, a surge protection device connected to a circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the surge protection device. The surge protection device shall be located directly adjacent to the circuit breaker.
 - 5. The surge protection device shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 - 6. The complete panelboard including the surge protection device shall be UL67 listed.
 - 7. The surge protection device shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer.

8. The surge protection device shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
 9. All monitoring and diagnostic features shall be visible from the front of the equipment.
- B. Sidemount Mounting Applications Installation (surge protection device mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices. Phase conductors shall be twisted per manufacturer's requirements.

3.03 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

END OF SECTION

SECTION 16402
UNDERGROUND DUCTBANKS

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - "Electrical Work" for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Ductbanks and underground pull boxes shown on plans are assumed worst case site conditions. Locations, quantities and routing may adjusted to facilitate installation per N.E.C.

1.01 SECTION INCLUDES

- A. Underground electrical duct banks.

1.02 REFERENCES

- A. National Fire Protection Association (NFPA): No. 70 - National Electrical Code (NEC) Appendix B.

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval.
- B. Catalog cut sheets of the ducts and spacers.
- C. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Have duct spacers and associated hardware packed and crated to avoid damage during shipment and handling.

- B. Clearly mark packages or crates stating that the material is for electrical duct banks only.

PART 2 PRODUCTS

2.00 ACCEPTABLE MANUFACTURERS

- A. Thomas and Betts.
- B. Underground Devices Inc.
- C. Walker Division, Butler Manufacturing Company.
- D. Carlon
- E. Or approved equal

PART 3 MATERIALS AND EQUIPMENT

- 3.00 Conduit: Construct ducts using schedule 80 rigid PVC conduit. Refer to Section 16111 – “Conduit, Fittings, and Bodies.”
- 3.01 Spacers: Secure conduit with non-magnetic, universal, interlocking-type spacers for both horizontal and vertical duct arrangements.
- 3.02 Concrete: Use steel reinforced, red concrete as duct encasement. Provide Class F concrete in non-truck traffic areas. Provide Class C concrete under gravel or asphalt driveways subject to heavy traffic.
- 3.03 Where unprotected service conductors are routed through a pull box with other conductors a divider wall shall be provided in the pull box for separation as required by the NEC.

PART 4 EXECUTION

4.00 PREPARATION

- A. Verify from Drawings and field survey that the location of ductbanks does not interfere with any existing or new underground facilities. Adjust route of electrical conduits and ductbanks below proposed or existing buried piping. Provide minimum 24-inch clearance vertically and horizontally. This work shall be performed in a satisfactory manner and at no additional cost to Owner.
- A. Verify that materials are on site in proper condition and that sufficient quantity is on hand for the work.
- B. Verify that trenches are in the correct places and prepared with sufficient depth and width to accommodate the duct banks, reinforcing rod, and concrete.
- C. Be prepared for inspection of the duct banks before reinforcing rod is installed.
- D. Before pouring concrete, verify that the ducts are free of debris and properly installed in the support and spacer systems and that the ducts are properly fitted together and firmly held in place by the hold down hardware.
- E. Provide 24-hour notice to Engineer and the Local Code Inspector for cover-up inspection before pouring electrical conduit ductbanks.

4.01 EXCAVATION AND BACKFILL

- A. All underground conduits shall be buried to a minimum depth of 24-inches below finished grade. All trenches shall be uniform width and shall be backfilled and compacted to 95 percent that of original density. Any damage to underground conduits caused by other Contractor's shall be repaired by this Contractor and shall be compensated accordingly by the party or parties responsible for the damage. Concrete shall be poured evenly on all sides of ductbanks. Do not over pour and do not dump spoils on site.
- B. Do not cut paved driveways, sidewalks, etc. Bore under such construction, maintaining a minimum of 24 inches below the underside of the pavement or concrete.

- C. All underground duct banks require inspection prior to concrete pour and inspection prior to covering the concrete. Contact the Inspector, or if not available, contact the Engineer for inspections. Schedule minimum 48 hours in advance. Any duct banks not inspected will be required to be exposed for inspection by Engineer regardless of status of concrete slabs or foundations.

4.02 INSTALLATION

- A. All underground conduit routing on site plan shall be followed as close as practical. Do not route conduits diagonally across property unless clearly shown as such or, with Engineer's written approval. Any conduits added or changed shall be indicated to Engineer on marked up drawing and submitted for approval. Any unauthorized changes shall be corrected at Contractor's expense, regardless of time discovered by Engineer and, in which case existing concrete shall not be cut or damaged but, shall be replaced in its entirety as shown on the plans as new construction. Do not route underground conduits in conflict with structures or obstructions.
- B. Allow in bid for relocation of underground conduits up to 20 feet to avoid obstructions shown on all other drawings issued under this contract. Coordinate prior to installation of conduits.
- C. Use the size and types of conduit as indicated on the Drawings for the various duct banks required for the project.
- D. Make duct bank installations and penetrations through foundation walls watertight.
- E. Assemble ductbanks using non-magnetic saddles, spacers, and separators. Position separators to provide 3-inch minimum concrete separation between the outer surfaces of the conduits.
- F. Provide a 3-inch minimum concrete covering on both sides, top and bottom of concrete envelopes around conduits. Add red dye at the rate of 10 pounds per cubic yard to concrete used for envelopes for easy identification during subsequent excavation.
- G. Firmly fix ducts in place during pouring of concrete. Carefully spade and vibrate the concrete to ensure filling of spaces between ducts.
- H. Make bends with sweeps of radius not less than 6 times the smallest diameter of the raceway.

- I. Make a transition from non-metallic to metallic rigid conduit where duct banks enter structures or turn upward for continuation above grade.
- J. Make bends of 30 degrees or more using rigid galvanized steel.
- K. Reinforce duct banks throughout, where indicated on the Drawings.
 - 1. Unless otherwise noted on the Drawings, reinforce with No. 5 longitudinal steel bars placed at each corner and along each face at a maximum parallel spacing of 12 inches on centers, and No. 5 tie-bars transversely placed at 18-inch maximum longitudinal intervals.
 - 2. Maintain a maximum clearance of 3 inches from bars to the edge of the concrete encasement.
- L. Where ducts enter structures such as handholes, manholes, pull boxes, or buildings, terminate the ducts in suitable end bells, insulated L-bushings, Myers hubs or couplings on steel conduits. Tag conduit entering pull boxes with stamped, stainless steel tags. Identify as designated in cable and conduit schedule.
- M. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials that can damage or contribute to corrosion of ducts or prevent adequate compaction of fill.
- N. Install a bare stranded copper duct bank ground on top of duct bank. Make ground electrically continuous throughout the entire duct bank system. Connect ground to switchgear and MCC ground buses and to steel conduit extensions of the underground duct system.
- O. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately one-fourth inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to remove any particles of earth, sand or gravel that may have been left in the duct. Re-pull the rag or sponge swab until the swab emerges clean.
- P. Use hemp rope to pull conductors into PVC conduit. Do not use nylon or wire cable for this purpose.
- Q. Install a warning ribbon approximately 12 inches below finished grade over underground duct banks. Refer to Section 16195 – “Electrical Identification.”

- R. For manholes and pull boxes below grade, install racks to support cables properly around the perimeter and keep them dry. Arrange cables in orderly fashion and tie to racks. If metallic racks are used, provide grounding per NEC.
- S. For manholes and pull boxes below grade, construct a french drain, or other drainage as detailed on the Drawings.
- T. All manhole and U.G. pull boxes used for electrical construction are to have the work “Electrical” permanently embossed on cover.
- U. Conduits penetrating underground pull boxes shall be sealed with CSBE seals where larger than 1 ¼-inch diameter and with RTV silicon based sealant where smaller than 1 ½-inch diameter.
- V. Conduits penetrating structural walls of lower levels shall be sealed with CSBE seals where larger than 1 ¼-inch diameter and with RTV silicon based sealant where smaller than 1 ½-inch diameter.
- W. All conduit duct banks penetrating lower level structures and penetrating underground pull boxes shall be sealed watertight between conduit and wall of structure or pull box.
- X. Install identification tags on all conduits at manholes, pull boxes, and junction boxes.
- Y. Conduits shall be separated by means of manufactured interlocking “chairs” spaced at no more than 5 feet apart along the length of the ductbank. Spacing between conduits shall not be less than 3 inches.
- Z. Every effort shall be made to minimize the number of bends in all ductbank systems. Field bends shall be made using a “hot box” designed for the size of PVC used. Care shall be given to ductbank routing so that very large radius sweeping turns are designed into the route as opposed to factory made 45° and 90° bends. When factory 90° bends are used, they shall be a minimum of 36-inch radius for 4 inch and 48-inch radius for 5 inch. Factory 90° bends used in ductbank construction shall be rigid metal conduit (ferrous) only. These factory made bends shall be protected by corrosion tape such as 3M Scotchrap 50 or approved equal prior to the concrete pour.
- AA. The ductbank support “chairs” shall be spaced up from the bottom of the trench using cement brick to insure that the proper amount of concrete is poured under the conduits. Sides of the trench may be used as the form if the width does not exceed 1 ½ times the recommended dimension of the ductbank (width.)

- BB. The Electrician shall vacuum, swab, and install pull strings in every conduit of the completed ductbank. The pull string shall be permanently marked in 1-foot increments to aid in wire estimation on future projects. Use Greenlee #435 pull string or approved equal.
- CC. Route all electrical ductbanks and conduits below water lines. Maintain minimum of 24 inches between bottom of water line and top of ductbank.
- DD. Electrical ductbanks are not required below concrete floors of buildings or below process equipment slabs, at which locations conduits shall be encased in minimum 3 inches of stabilized sand. Where ductbanks are shown on plans to be routed under existing concrete slabs or pavements, install per plan details. Do not cut rebar in existing conduit except where approved by Engineer. Repair any cut or damaged rebar by welding back together after conduits are installed. Submit detail of intent for cutting or removal of existing concrete for ductbank installation to Engineer for approval.
- EE. A fish wire shall be left in all conduits in which the permanent wiring is not installed.

END OF SECTION

SECTION 16410
POWER FACTOR CORRECTION

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Refer to drawing details for mounting requirements.
- D. Install capacitors on all motors over 5 horsepower. Where motor starter is a solidstate device, provide contactor mounted to MCC bus activated by starter with time delay relay indicator and HOA switch. Provide circuit breaker at bus for overcurrent protection. Provide this requirement whether shown on plans or not.

1.01 SUMMARY

- A. Section Includes: Power factor correction equipment.

1.02 SUBMITTALS

- A. Submit the following for Engineer’s approval.
- B. Product Data:
 - 1. Include data on features, components, ratings, and performance.
 - 2. Include calculations or motor data schedules used to determine capacitor size for each motor 5 horsepower and greater. Provide correction to minimum 0.96 and in no case greater than 0.99. Motors less than 25 horsepower with greater than 0.9 power factor and with solidstate soft starters do not require correction.
 - 3. Provide detail of location and mounting method for Engineer’s approval of location.

- C. Operating and Maintenance Data (O&M):
 - 1. Maintenance data for system and products for inclusion in Operating and Maintenance Manual.
 - a. List of spare parts and replacement components recommended being stored at site for ready access.
 - b. Detailed operating instructions covering operation under both normal and abnormal conditions.
- D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exceptions" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.
- B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- C. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

1.04 MAINTENANCE

- A. Extra Materials:
 - 1. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to Owner.
 - 2. Fuses: Ten (10) of each type and rating.

3. Blown Fuse Indicating Lamps: Ten (10) lamps of each type and rating.

PART 2 PRODUCTS

2.01 SERVICE CONDITIONS

- A. Environmental Conditions: Equipment withstands following environmental conditions while in operation without mechanical or electrical damage or degradation of operating capability:
 1. Ambient Temperature: Minus 20°C to plus 40°C.
 2. Altitude: Sea level to 500 ft.

2.02 CAPACITORS, GENERAL

- A. Manufacturers:
 1. Power Factor Correction Capacitors – General Use:
 - a. Aerovox.
 - b. ARCO Electric Products Corp.
 - c. Myron Zucker, Inc.
 - d. Square D Co.
 - e. Cutler Hammer
 - f. Siemens
 - g. Or approved equal
 2. Power Factor Correction Capacitor – Tray Mount:
 - a. Tray mount by Myron Zucker Inc., for specific MCC Manufacturer.
 - b. Pre-approved equal.
- B. Capacitors: Comply with UL 819 and applicable requirements of NEMA CP1 and IEEE 18.

- C. Construction: Multiple capacitor cells or elements wired together in 3-phase groups and mounted in metal enclosures.
- D. Capacitor Cells: Dry metalized dielectric, self-healing type. Each cell is encapsulated in thermosetting resin inside plastic container.
- E. Cell Rupture Protection: Equip each cell with an NRTL recognized pressure-sensitive interrupter.
- F. Fuses for Protection of Capacitor Banks: Current-limiting, non-interchangeable type, factory-installed in each phase and located within equipment enclosure. Features include:
 - 1. Interrupting Capacity: 200,000 amperes.
 - 2. Fuse Ratings and Characteristics: As recommended by manufacturer for specific capacitor bank protected.
 - 3. Blown Fuse Indicator: Neon lamps for each fuse, connected to light when fuse has opened, and visible from outside enclosure.
- G. Enclosure: Steel or aluminum, arranged to contain fluid leakage from capacitor cells. Factory-equip with mounting brackets suitable for type of mounting indicated.
 - 1. Indoor Enclosures: Dust-tight or as indicated.
 - 2. Outdoor Enclosures: Gasketed doors or covers and equipped with watertight conduit connections.
 - 3. MCC tray mount in bucket spaces mounting required where MCC is used. Provide additional MCC sections as required.

2.03 FIXED CAPACITORS

- A. Integrally fused except as indicated, with quantities, ratings, mounting provisions and electrical connections as indicated.
- B. Discharge Resistors: Factory-installed and -wired.
- C. Internal Wiring: Completely factory-wired, ready for field connection to external circuits at single set of pressure terminals.

2.04 FACTORY FINISH

- A. Finish: Manufacturer's standard enamel over corrosion-resistant treatment or primer coat.

2.05 SOURCE QUALITY CONTROL

- A. Factory-test power factor correction equipment prior to shipment. Include following:
 - 1. Routine capacitor production tests, including short-time overvoltage test, capacitance test, leak test, and dissipation factor test.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount equipment as indicated. Do not mount over top of motor control centers or switchgear.
- B. Install fixed tray mount style capacitors in MCC bucket space near associated motor starter. Where MCC not used, install wall mount style capacitors with stainless steel brackets.
 - 1. Connect on line side of motor starter overload elements and switch with motor.
 - 2. Install fuse holders and fuses within capacitor enclosures.
- C. Maintain minimum working space at live parts according to manufacturer's written instructions.
- D. Install capacitor one (1) each motor, 5 horsepower and above.
- E. Provide contactor with circuit protection device, H.O.A. and time delay relay for capacitors connected to main power bus for solid-state starters. Do not connect capacitors directly to motor or on the load side of starter where solid-state or VFD starters are installed. Contractor shall shunt capacitor on MCC bus.
- F. Provide drawing and detail of each capacitor installation and submit for Engineers approval of location and method of installation.

3.02 IDENTIFICATION

- A. Identify components according to Section 16195 – “Electrical Identification.”

3.03 FIELD QUALITY CONTROL

- A. Testing: Test system functions, operations, and protective features according to manufacturer's written instructions.

- B. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- C. Measure power factor with appropriate instruments and provide report to Engineer for evaluation.

3.04 CLEANING

- A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

END OF SECTION

SECTION 16452

GROUNDING

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SUMMARY

- A. Section includes:
 - 1. Solid grounding of electrical systems and equipment.
 - 2. Basic requirements for grounding for protection of life, equipment, circuits, and systems.
 - 3. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. B3 - Standard Specification for Soft or Annealed Copper Wire.
 - 2. B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
 - 3. B33 - Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
 - 4. E699 - Standard Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components.
- B. National Fire Protection Association (NFPA): NFPA 780 – Standard for the Installation of Lightning Protection Systems.

- C. Underwriter's Laboratories (UL): 467 - UL Standard for Safety Grounding and Bonding Equipment.

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval.
- B. Test Results: Report of field tests and observations certified by Contractor.
- C. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 QUALITY ASSURANCE

- A. Items provided under this section shall be listed OR labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING PRODUCTS

- A. Products: Of types indicated and of sizes and ratings to comply with current NEC. Where types, sizes, ratings, and quantities indicated are in excess of current NEC requirements, more stringent requirements and greater size, rating, and quantity indications govern.
- B. Conductor Materials: Copper.

2.02 WIRE AND CABLE CONDUCTORS

- A. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductor: Green insulated.
- C. Grounding Electrode Conductor: Stranded cable.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Assembly of Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.

2.03 MISCELLANEOUS CONDUCTORS

- A. Ground Bus: Bare annealed copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.
- C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inch wide, except as indicated.

2.04 CONNECTOR PRODUCTS

- A. General: Listed and labeled as grounding connectors for materials used.
- B. Pressure Connectors: High-conductivity-plated units.
- C. Bolted Clamps: Heavy-duty units listed for application.
- D. Exothermic Welded Connections: Provide in kit form and select for specific types, sizes, and combinations of conductors and other items to be connected.

2.05 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
 - 1. Size: 3/4 inch by 20 feet unless otherwise indicated.

2. Exothermic welded connections only.
- B. Plate Electrodes: Copper plates, minimum 0.10 in. thick, size as indicated.

PART 3 EXECUTION

3.01 APPLICATION

- A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
1. Install separate insulated equipment grounding conductors with circuit conductors.
 - a. Raceway shall not be used as equipment ground conductor unless specifically permitted or shown on plans.
 - b. Install insulated equipment ground conductor in nonmetallic raceways unless designated for telephone or data cables.
- B. Underground Conductors: Bare, tinned, stranded copper except as otherwise indicated.
- C. Signal and Communications: For telephone, alarm, instrumentation and communication systems, provide #4 AWG minimum green insulated copper conductor in raceway from grounding electrode system to each terminal cabinet or central equipment location.
- D. Ground separately derived systems required by NEC to be grounded in accordance with NEC Paragraph 250-30.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to grounding electrode as indicated on plans in addition to separate equipment grounding conductor run with supply branch circuit.
- F. Connections to Lightning Protection System: Bond grounding conductors or grounding conductor conduits to lightning protection down conductors or grounding conductors in compliance with NFPA 780. Use exothermic connections.
- G. Common Ground Bonding With Lightning Protection System:
1. Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode, using exothermic welded connection.

2. Use bonding conductor sized same as system ground conductor and installed in conduit.
- H. At all water, wastewater and industrial facilities, install UFER grounding per Item 3.02 – “Installation” at all equipment structures and buildings unless specifically deleted.
- I. Bond all metallic fences, gates, posts, steel structural columns, and other exposed steel structures.
- J. Install ground rod at all outdoor control panels, transformers, service racks, equipment enclosures, equipment racks, radio towers, steel canopy structures, and other steel structures where electrical equipment is installed.
- K. Ground all motor frames using bar copper conductor grid looped to all motors and terminating at ground rods via exothermic connection.

3.02 INSTALLATION

- A. General: Ground electrical systems and equipment in accordance with current NEC requirements except where Drawings or Specifications exceed NEC requirements.
- B. Ground Rods:
 1. Locate minimum of one-rod length from each other and at least same distance from any other grounding electrode.
 2. Interconnect ground rods with bare conductors buried at least 24 in. below grade.
 3. Connect bare-cable ground conductors to ground rods by means of exothermic welds.
 4. Make connections without damaging copper coating or exposing steel.
 5. Use 3/4-inch by 20-ft. ground rods except as otherwise indicated.
 6. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated. Do not locate where obstructing standing or walk space.
 7. Install a minimum of two ground rods for motor and equipment grounding grids. Locate at opposite ends of grid loop.

- C. Metallic Water Service Pipe:
 - 1. Provide insulated copper ground conductors, sized as indicated, in conduit from building main service equipment, or ground bus, to main metallic water service entrances to building.
 - 2. Connect ground conductors to street side of main metallic water service pipes by means of ground clamps.
 - 3. Bond ground conductor conduit to conductor at each end.
- D. Braided-Type Bonding Jumpers: Use elsewhere for flexible bonding and grounding connections.
- E. Route grounding conductors along shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.
- F. Test Wells: Where “test well” are specifically shown on plans, locate as indicated, and fabricate in accordance with details indicated.
- G. UFER Ground:
 - 1. Fabricate with 20 feet of bare 2/0 (minimum) copper conductor laid lengthwise in excavation for foundation or footings.
 - 2. Install so conductor is within 2 in. of bottom of concrete.
 - 3. Where base of foundation is less than 20 feet in length, coil excess conductor at base of foundation.
 - 4. Bond conductor to reinforcing steel at four locations, minimum. Bond to all electrical equipment.
 - 5. Extend conductor below grade and connect to building grounding grid or grounding electrode.
 - 6. Extend to all steel support columns for buildings, equipment structures or roof columns.
 - 7. Alternate UFER Grounding: Install 2/0 (minimum) bare copper conductor in 24” deep trench around perimeter of structures, buildings, slabs, and foundations where electrical or mechanical equipment is located.

Install 4 ft. from edge of structure. Bond to all steel structure and equipment and to grounding system, using exothermic welded connections.

8. Do not install ground grid conductors in or under existing concrete adjacent to generators electrical equipment without written approval from Engineer.

H. Surge Protection Device (SPD) Grounding:

1. **Route SPD ground conductor directly to driven ground rod. Route with minimum possible bends in conduits. Do not ground SPD's to ground bus at MCC only.**

3.03 CONNECTIONS

A. General: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
2. Make connections with clean bare metal at points of contact.
3. Aluminum to steel connections: stainless steel separators and mechanical clamps.
4. Aluminum to galvanized steel connections: tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections involving dissimilar metals with inert material such as red paint to prevent future penetration of moisture to contact surfaces.

B. Exothermic Welded Connections:

1. Use for connections to ground rods, structural steel, water tanks, motors, ground grids, electrical/mechanical equipment, generators and enclosures, and for underground connections, except those at electrodes specifically designated on plans as "test wells".
2. Install at connections to ground rods and plate electrodes.
3. Comply with manufacturer's written recommendations. Use CAD-Weld or approved equal.

4. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Terminations:
1. Terminate insulated equipment grounding conductors for feeders and branch circuits with approved pressure-type grounding lugs.
 2. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to housing, terminate each conduit with grounding bushing.
 3. Connect grounding bushings with bare grounding conductor to ground bus in housing.
 4. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.
 5. Do not use metallic housing or mounting plates for ground path to other circuits.
- D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A-486B.
- E. Connections at "Test Wells": Refer to plan details for connections between conductors and ground rods only, where specifically noted. Otherwise, use exothermic well connections, where specifically designated as test well on plans.
- F. Compression-Type Connections: Where compression type connections are specifically called for on plans, use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make visible indication that connector has been adequately compressed on ground conductor.
- G. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.
- 3.04 OVERHEAD LINE GROUNDING
- A. General: Comply with ANSIC2, "National Electrical Safety Code" for "Single-Grounded Systems," using two or more electrodes in parallel if single electrode resistance to ground exceeds 25 ohms.

- B. Ground Rod Connections: Use exothermic welds for underground connections and connections to rods.
- C. Lightning Arresters: Separate arrester grounds from other ground conductors.
- D. Secondary Neutral and Tank of Transformer: Interconnect and connect to ground.
- E. Grounding Conductor Protection: Protect grounding conductors running on surface of wood poles with molding of a type manufactured for this purpose. Extend from grade level up to and through communications and transformer spaces.

3.05 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes and Handholes:

1. Install 3/4-inch by 20-ft. driven ground rod in corner close to wall and set rod depth such that 4 inches will extend above finished floor.
2. Where necessary, install ground rod before manhole is placed and provide No. 1/0 bare tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall, unless specifically shown otherwise on plans.
3. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 in. above to 6 in. below concrete.
4. Seal floor opening with waterproof non-shrink grout.

B. Connections at Manholes:

1. Connect exposed metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole to ground rod or ground conductor.
2. Make connections with minimum No. 4 AWG stranded hard-drawn copper wire.
3. Train conductors plumb or level around corners and fasten to manhole walls.
4. Connect to cable armor and cable shields by means of tinned terminals soldered to armor or shield, or as recommended by manufacturer of splicing and termination kits.

- C. Grounding System: Ground non-current-carrying metallic items associated with manholes, substations, and pad-mounted equipment by connecting them to bare underground cable and grounding electrodes arranged as indicated.

3.06 FIELD QUALITY CONTROL

A. Test:

1. Subject completed grounding system to megger test at each location where grounding rod is indicated in plans, including at service disconnect enclosure, surge protection devices, ground terminals, motors, MCCs, electrical equipment, steel structures, and at ground test wells.
2. Measure ground resistance without soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
3. Perform tests by 2-point method in accordance with Section 9.03 of IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System."

B. Ground/resistance maximum values shall be as follows:

1. Equipment rated 500 kVA and less: 10 Ohms.
2. Equipment rated 500 kVA to 1000 kVA: 5 Ohms.
3. Equipment rated over 1000 kVA: 3 Ohms.
4. Unfenced substations and pad-mounted equipment: 5 Ohms.
5. Manhole grounds: 10 Ohms.

- C. Deficiencies: Where ground resistances exceed specified values, drive additional rods (total of three) to achieve acceptable resistance. Notify Engineer after first rod measurement, and if directed by Engineer, provide the additional ground rods to reduce resistance values.

- D. Report: Prepare test reports, certified by testing organization, of ground resistance at each test location. Note if additional rods are required as described in item C above. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.07 RESTORATION

- A. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated.
- B. Where sod has been removed, replace it as soon as possible after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition.
- D. Include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.
- E. Restore disturbed paving as indicated.

END OF SECTION

SECTION 16460
TRANSFORMERS

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SUMMARY

- A. Section Includes:
 - 1. General Purpose, Dry Type Transformers.
 - 2. Drive Isolation Transformers.
 - 3. Control and Signal Transformers.
 - 4. Mini Power Zone Packaged Power Supply

1.02 REFERENCES

- A. American National Standards Institute, Inc. /Institute of Electrical and Electronics Engineers (ANSI/IEEE):
 - 1. ANSI/IEEE C2 - National Electrical Safety Code.
 - 2. ANSI/IEEE C57.12.80 Standard Terminology for Power and Distribution Transformers.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LA 1 - Surge Arresters.
 - 2. NEMA ST 1 - Specialty Transformers (Except General-Purpose Type).
 - 3. NEMA ST 20 - Dry-Type Transformers for General Applications.

- C. Underwriters Laboratories, Inc. (UL):
 - 1. UL 486A- Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 - 2. UL 506 - Specialty Transformers.

1.03 SUBMITTALS

- A. Submit the following for Engineer's approval.
- B. Product Data:
 - 1. Dimensional plans and sections.
 - 2. Elevations showing minimum clearances.
 - 3. Installed devices.
 - 4. Materials list.
 - 5. Weights.
 - 6. Wiring diagrams.
 - 7. Manufacturer's nameplate data and electrical ratings.
- C. Product Test Reports:
 - 1. Certified copies of manufacturer's design and routine factory tests required by reference standards.
 - 2. Submit after manufacture of transformer and before installation.
- D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.04 QUALITY ASSURANCE

- A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Terms "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
- C. ANSI/IEEE Compliance: Comply with applicable requirements of ANSI/ IEEE standards, including ANSI/IEEE C2 and C57.12.80.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Square D.
- B. General Electric.
- C. Or equal.

2.02 TRANSFORMERS, GENERAL

- A. Transformers:
 1. Factory-assembled and tested, air-cooled units of types specified, having characteristics and ratings as indicated.
 2. Design unit for 60 Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices, except for taps.
- D. Internal Coil Connections: Brazed or pressure type.
- E. Bolt coil/core to bottom of enclosure for transformers larger than 15 kVA.
 1. Isolated by rubber, vibration-absorbing mounts.
 2. Metal-to-metal contact between coil/core and enclosure not allowed.
- F. Provide copper windings.

- G. Nameplates: Provide metal nameplate listing manufacturer's name, serial number, type, class, kVA voltage, frequency, and showing internal wiring diagram.
- H. Sound Level: Minimum 3 dB less than sound levels for transformer type and size indicated when factory-tested in accordance with NEMA ST 20.
- I. Enclosures at wastewater treatment plant outdoor or chemical area locations to be NEMA 4X stainless steel.

2.03 GENERAL PURPOSE, DRY TYPE TRANSFORMERS

- A. Comply with NEMA ST 20.
- B. Windings: 2-winding type. 3-phase transformers shall use 1 coil/ phase in primary and secondary.
- C. Transformers shall have following features and ratings.
 - 1. Enclosure: Indoor, ventilated unless otherwise shown on plans, outdoor, weather proof unless shown otherwise on plans.
 - 2. Insulation Class: 185°C or 220°C class for transformers 15 kVA or smaller; 220°C class for transformers larger than 15 kVA.
 - 3. Insulation Temperature Rise: 80°C maximum rise above 40°C for 15 kVA and larger; 115°C maximum rise above 40°C below 15 kVA.
 - 4. Taps: For transformers 3 kVA and larger, full capacity taps in high voltage winding as follows.
 - a. 3 through 10 kVA: Two 5% taps below rated high voltage.
 - b. 15 through 500 kVA: Six 2-1/2% taps, 2 above and 4 below rated high voltage.
 - c. 750 through 1,000 kVA: Four 2-1/2% taps, 2 above and 2 below rated high voltage.
- D. Accessories: Following accessory items are required where shown on Drawings.
 - 1. Surge Arresters: Low voltage type, factory-installed and connected to high voltage terminals; complying with NEMA LA 1.

2. Wall Mounting Brackets: Manufacturer's standard brackets for transformers sized up to 75 kVA where wall mounting indicated.
3. Electrostatic Shielding: Insulated metallic shield between primary and secondary windings. Connect to terminal marked "shield" for grounding connection, where applicable.

2.04 DRIVE ISOLATION TRANSFORMERS

- A. Comply with requirements of NEMA ST 1 and UL 506, except as specified below.
- B. Ratings:
 1. As indicated and continuous duty.
 2. Minimum kVA: 130% of motor nameplate hp.
- C. Type:
 1. Self-cooled, 2-winding, dry type especially designed for application, with special coil bracing to withstand electro-mechanical forces involved.
 2. 3-ph transformers shall use 1 coil/phase in primary and secondary.
- D. Transformers shall have following features and ratings.
 1. Enclosure: Indoor, ventilated unless otherwise shown on Drawings.
 2. Insulation Class: 220°C class.
 3. Insulation Temperature Rise: 115°C at 115% of rating.
 4. Taps: Two 5% full capacity taps, 1 above and 1 below rated high voltage.
 5. Temperature Sensing Device: Thermistor embedded in coil with leads brought out to terminal board.

2.05 CONTROL AND SIGNAL TRANSFORMERS

- A. Comply with NEMA ST 1 and UL 506.
- B. Ratings:
 1. As indicated and for continuous duty.

2. Where rating not indicated, provide 250 percent of load.
 - C. Type: Self-cooled, 2-winding dry type.
 - D. Enclosure: Indoor, except as indicated.
- 2.06 MINI POWER ZONE PACKAGED POWER SUPPLY
- A. Provide with primary breaker, transformer, secondary breaker, and circuit breaker panel as indicated on plans.
 - B. Enclosure shall be NEMA 4X for outdoor and wet area indoor use, NEMA 3R for dry outdoor use, NEMA 1 for dry indoor use, and NEMA 12 for dusty indoor use. Provide stainless steel enclosure where shown on plans.
 - C. Unit shall be rated for maximum full load temperature rise of 115°C.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Arrange equipment to provide adequate spacing for cooling air circulation.
- B. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values not indicated, use those specified in UL 486A and 486B.
- C. Install wall-mounted transformers on prefabricated brackets designed for purpose.
- D. Install floor-mounted transformers on 4-in. concrete housekeeping pad.
- E. Touch up scratched or marred surfaces to match original finish.
- F. Identify transformers as specified herein.
- G. Install lightning arresters as shown on Drawings.

3.02 GROUNDING

- A. Ground in accordance with Section 16452 – “Grounding.”
- B. Ground secondary transformers with separate driven ground rod.

3.03 FIELD QUALITY CONTROL

- A. Test and permanently record as follows.
 - 1. Prior to energization of transformers, test phase-to-phase and phase-to-ground insulation resistance levels.
 - 2. Test transformers for continuity of circuits and short-circuits.

3.04 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at utilization equipment.

3.05 CLEANING

- A. Upon completion of installation, inspect interiors and exteriors of accessible components.
 - 1. Remove paint splatters and other spots, dirt, and construction debris.
 - 2. Touch up scratches and mars of finish to match original.

3.06 PROTECTION

- A. Temporary Heating: Comply with manufacturer's written recommendations within enclosure of each transformer throughout periods during which equipment is not in a space continuously under normal control of temperature and humidity.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SUMMARY

- A. Section Includes: Lighting and power panelboards and associated auxiliary equipment rated 600 V or less.

1.02 REFERENCES

- A. Institute of Electrical and Electronic Engineers (IEEE):
 - 1. IEEE C62.1 - Standard for Gap Silicon-Carbide Surge Arrestors for AC Power Circuits.
 - 2. IEEE C62.11 - Standard for Metal-Oxide Surge Arrestors for AC Power Circuits.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA PB.1 - Panelboards.
 - 2. NEMA PB1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 volts or less.
- C. Underwriter's Laboratory (UL):
 - 1. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors, 7th Edition.
 - 2. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings, 5th Edition.

1.03 DEFINITIONS

- A. Load Center: Panelboard with thermal magnetic circuit-breaker branches, primarily of bolt-on type, designed for residential and light commercial projects, operating at 240 V and below, available in both single and 3-phase versions, and equipped with combination flush/surface mounting trim. Plug-in type breakers are not allowed.
- B. Overcurrent Protective Device (OCPD): Device operative on excessive current that causes and maintains interruption of power in circuit it protects.

1.04 SUBMITTALS

- A. Submit the following for Engineer's approval.
- B. Product Data:
 - 1. For each type panelboard, accessory item, and component specified.
 - 2. Identification materials.
- C. Shop Drawings:
 - 1. Dimensioned plans, sections, and elevations.
 - 2. Tabulations of installed devices, major features, and voltage rating.
 - 3. Include:
 - a. Enclosure type with details for types other than NEMA Type 1.
 - b. Bus configuration and current ratings.
 - c. Short-circuit current rating of panelboard.
 - d. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
- D. Wiring diagrams detailing schematic diagram including control wiring, and differentiating between manufacturer-installed and field- installed wiring.
- E. Report of field tests and observations in accordance with this section.
- F. Maintenance and Operations Data: Include instructions for testing circuit breakers.

- G. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.05 QUALITY ASSURANCE

- A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Terms "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Square D Co.
- B. General Electric
- C. Eaton Corp.
- D. Or equal.

2.02 PANELBOARDS, GENERAL REQUIREMENTS

- A. Construction in accordance with NEMA PB1.
- B. Overcurrent Protective Devices (OCPD’s):
 - 1. Provide type, rating, and features as indicated.
 - 2. Comply with Section 16475 – “Overcurrent Protective Devices” with OCPD’s adapted to panelboard installation.

3. Tandem circuit breakers shall not be used.
 4. Multi-pole breakers shall have common trip.
- C. Enclosures: Cabinets, enclosures, and panels, flush or surface mounted as indicated. NEMA Type 12 enclosure shall be use indoors, except where other enclosure requirements are indicated on drawings. All outdoor enclosures shall be NEMA 4X stainless steel. This includes indoor locations such as wastewater process areas and environmentally harsh locations.
- D. Front:
1. Secure to box with concealed trim clamps except as indicated.
 2. Front for surface-mounted panels shall be same dimensions as box.
 3. Fronts for flush panels shall overlap box except as otherwise specified.
- E. Directory Frame: Metal, mounted inside each panel door.
- F. Bus: Hard drawn copper of 98 percent conductivity.
- G. Main and Neutral Lugs: Mechanical type.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
- I. Service Equipment Approval: Listed for use as service equipment for panelboards having main service disconnect.
- J. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.
- K. Special Features: Provide following features for panelboards as indicated.
1. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 2. Split Bus: Vertical bus of indicated panels divided into two vertical sections with connections as indicated.
 3. Extra Gutter Space: Dimensions and arrangement as indicated.

4. Auxiliary Gutter: Conform to UL 870.
5. Column-Type Panelboard Configuration: Narrow cabinet extended as wireway to overhead junction box equipped with ground and neutral terminal buses.
6. Sub-feed: OCPD or lug provision as indicated.
7. Feed-Through Lugs: Sized to accommodate feeders indicated.
8. Surge Arresters: For panelboards as indicated on Plans.
 - a. Comply with IEEE C62.11 or IEEE C62.1.
 - b. Description: Coordinate impulse sparkover voltage with system circuit voltage and provide factory mounting with UL-recognized mounting device.

2.03 LOAD CENTERS

- A. Provide load-center-type panelboards only where specifically indicated.
- B. OCPD's: Plug-in full module (nominal 1-in. width) circuit breaker.
- C. Circuit Breakers for Switching Lights at Panelboards: Indicated type SWD.
- D. Circuit Breakers for Equipment Marked HCAR Type: Indicated HCAR type.
- E. Interiors: Provide physical means to prevent installation of more OCPD's than quantity for which enclosure was listed.
- F. Main, Neutral, and Ground Lugs and Buses: Mechanical connectors for conductors.

2.04 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

- A. Branch OCPD's: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.05 DISTRIBUTION PANELBOARDS

- A. Branch-Circuit Breakers: Where OCPD's are indicated to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.

B. Doors:

1. In panel front, omit single panelboard door in cabinet front for fusible switch panelboards except as indicated.
2. Secure with vault-type with tumbler lock, all keyed alike.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: Arranged to permit testing of functions of solid-state trip devices without removal from panelboard.
- C. Spare Fuse Cabinet: Identified, compartmented, lockable steel box or cabinet with compartments suitable for surface mounting on wall.
- D. All equipment, instruments and devices provided for this project shall have means of protection from power line conditions such as surge, phase fail, or other line conditions that may damage equipment, instruments or devices furnished. It is vendors and manufacturers' responsibility to provide protective devices as required for maintaining warranty of furnished items and to assure no damage occurs from power line conditions.

2.07 IDENTIFICATION

- A. General: Provide nameplates for all panelboards.
- B. Panelboard Nameplates: Engraved laminated plastic for each panelboard.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install panelboards and accessory items in accordance with NEMA PB 1.1, and manufacturers' written installation instructions, and approved submittals.
- B. Mounting Heights: Top of trim 6 ft 2-in. above finished floor, except as indicated.
- C. Mounting:
 1. Plumb and rigid without distortion of box.

2. Mount flush panels uniformly flush with wall finish.
 - D. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.
 - E. Install filler plates in unused spaces.
 - F. Provision for Future Circuits at Flush Panelboards:
 1. Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future.
 2. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.
 - G. Auxiliary Gutter: Install where a panel is tapped to a riser at an intermediate location.
 - H. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.
- 3.02 IDENTIFICATION
- A. Identify field-installed wiring and components and provide warning signs in accordance with Section 16195 – “Electrical Identification.”
- 3.03 GROUNDING
- A. Connections: Make equipment grounding connections for panelboards as indicated.
 - B. Provide ground continuity to main electrical ground bus indicated.
 - C. Ground in accordance with Section 16452 – “Grounding.”
- 3.04 CONNECTIONS
- A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque- tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.
- 3.05 FIELD QUALITY CONTROL
- A. Perform tests on low-voltage power panelboards and accessories.

- B. Upon completing installation of system, perform following tests:
 - 1. Make insulation resistance tests of panelboard buses, components, and connecting supply, feeder, and control circuits.
 - 2. Make continuity tests of circuits.
- C. Quality Control Program.
 - 1. Procedures: Make field tests and inspections and prepare panelboard for satisfactory operation in accordance with manufacturer's recommendations and these specifications.
 - 2. Notify Engineer at least one week in advance of testing.
 - 3. Report Testing:
 - a. Report written reports of tests and observations.
 - b. Report defective materials and workmanship and unsatisfactory test results.
 - c. Include records of repairs and adjustments made.
 - 4. Protective Device Ratings and Settings:
 - a. Verify indicated ratings and settings to be appropriate for final system configuration and parameters.
 - b. Where discrepancies are found, recommend final protective device ratings and settings.
 - c. Use accepted ratings or settings to make final system adjustments.
- D. Visual and Mechanical Inspection: Include following inspections and related work:
 - 1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
 - 2. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction.
 - 3. Check panelboard mounting, area clearances, and alignment and fit of components.

4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 5. Perform visual and mechanical inspection and related work for overcurrent protective devices as within this section.
- E. Electrical tests: Include following items performed in accordance with manufacturer's instruction:
1. Insulation resistance test of buses and portions of control wiring that disconnected from solid-state devices. Insulation resistance less than 100 megohms is not acceptable.
 2. Ground resistance test on system and equipment ground connections.
 3. Test main and sub-feed overcurrent protective devices in accordance within this section.
- F. Retest: Correct deficiencies identified by tests and observations and provide retesting of panelboards. Verify by system tests that total assembly meets specified requirements.

3.06 CLEANING

- A. Upon completion of installation, inspect interior and exterior of panelboards.
- B. Remove paint splatters and other spots, dirt, and debris.
- C. Touch up scratches and mars of finish to match original finish.
- D. Clean interior of panelboard.

3.07 ADJUSTING

- A. Adjust doors and operating mechanisms for free mechanical movement.

3.08 COMMISSIONING

- A. Balancing Loads: After Substantial Completion, but before Final Acceptance, conduct load-balancing measurements and circuit changes as follows:
 1. Perform measurements during period of normal working load as advised by Owner.

2. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hr services such as Fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. Recheck loads after circuit changes during normal load period. Record load readings before and after changes and submit test records.
4. Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Re-balance and recheck as required to meet this minimum requirement.

END OF SECTION

SECTION 16475
OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - "Electrical Work" for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.01 SUMMARY

- A. Section Includes: Overcurrent protective devices (OCPD's) rated 600V and below and switching devices commonly used with them.

1.02 REFERENCES

- A. National Electrical Manufacturers Association (NEMA).
 - 1. NEMA KS-1-83 - Enclosed Switches.
 - 2. NEMA 250-85 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 3. NEMA FU1-86 - Low Voltage Cartridge Fuses.
 - 4. NEMA AB1-86 - Molded Case Circuit Breakers and Molded Case Switches.
- B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC).
- C. Underwriters Laboratory (UL):
 - 1. UL 98-87 - Enclosed and Dead Front Switches.
 - 2. UL 198C-86 - High-Interrupting Capacity Fuses, Current-Limiting Types. Fifth Edition.
 - 3. UL 198E-88 - Class R Fuses. Fourth Edition.
 - 4. UL 486A-80 - Wire Connectors and Soldering Lugs for Use with Copper Conductors. Seventh Edition.

5. UL 489-86 - Molded-Case Circuit Breakers and Circuit-Breaker Enclosures. Seventh Edition.
6. UL 943-85 - Ground-Fault Circuit Interrupters. Second Edition.
7. UL 977-84 - Fused Power-Circuit Devices. Third Edition.
8. UL 198L-88 - UL Standard for Safety D-C Fuses for Industrial Use.

1.03 DEFINITIONS

- A. Overcurrent Protective Device (OCPD): Device operative on excessive current that causes and maintains interruption of power in circuit it protects.
- B. Ampere-Squared-Seconds: Expression of available thermal energy resulting from current flow. With regard to current-limiting fuses and circuit breakers, ampere-squared-seconds during fault current interruption represents energy allowed to flow before fuse or breaker interrupts fault current within its current limiting range.

1.04 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval.
- B. Shop Drawings: Spare fuse cabinet showing dimensions and features including storage provision for fused cartons, where shown on plans.
- C. Product Data:
 1. Product data for fuses, fusible switches, circuit breakers, and OCPD accessories specified in this Section, including descriptive data and time-current curves for protective devices and let-through current curves for those with current limiting characteristics.
 2. Include coordination charts and tables and related data.
- D. Test Results: Certified reports of field tests and observations.
- E. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

- F. Coordination: Contractor shall determine size, horsepower, voltage and phase of all equipment and motors supplied and shall adjust breaker and fused switch size accordingly and shall note on submittals. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.05 QUALITY ASSURANCE

- A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

- 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
- 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

- B. Regulatory Requirements:

- 1. Components and Installation:
 - a. NFPA 70 "National Electrical Code (NEC)."
 - b. Local codes and ordinances.

- C. Single-Source Responsibility: Obtain similar OCPD's from single manufacturer.

- D. Coordinate OCPD sizes with characteristics of motors supplied for this project. Pay special attention to high efficiency motors.

- E. Handle operator mechanisms shall be on side of enclosure and not on front. Keyed mechanisms that separate handle from breaker mechanism when door is opened are not acceptable.

1.06 MAINTENANCE

- A. Extra Materials:

- 1. Maintenance Stock, Fuses: For types, voltage, and ampere ratings required furnish 10% spare fuses, but not less than one (1) set of three (3) of each kind.

PART 2 PRODUCTS

2.00 OVERCURRENT PROTECTIVE DEVICES (OCPD'S), GENERAL

- A. General: Provide OCPD's in indicated types, as integral components of panelboards, switchboards, and motor control centers; and as individually enclosed and mounted single units.
- B. Enclosures: NEMA 250, except that all outdoor areas and indoor environmentally harsh locations such as wastewater process areas shall be NEMA 4X stainless steel.

2.01 GENERAL FUSES

- A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with circuits on which used.
- B. Fuses for Direct Current Circuits: UL 198L and marked for such use by manufacturer on fuse label.
- C. Cartridge Fuse:
 - 1. Manufacturers:
 - a. Bussmann Div., Cooper Industries, Inc.
 - b. Gould Shawmut.
 - c. Littelfuse Inc.
 - 2. NEMA Standard FU1, unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage ratings consistent with circuits on which used.
 - 3. Class CC Fuses: UL 198C.
 - 4. Class J Fuses: UL 198C.
 - 5. Class L Fuses: UL 198C.
 - a. Current limiting threshold of 10 times current rating or less and time delay of 4 sec at 5 times rating.
 - 6. Class RK1 and RK5 Dual Element Time-Delay Fuses: UL 198E.

7. Class RK1 Fast-Acting Fuses: UL 198E.

2.02 FUSIBLE SWITCHES

A. Manufacturers:

1. Square D Co.
2. General Electric
3. Eaton Corp.
4. Or equal.

B. UL 98 and NEMA KS 1 quick-make, quick-break heavy-duty units.

C. Rating: Load-breaking capacity in excess of normal horsepower rating for switch.

D. Withstand Capability: In excess of let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.

E. Operation: By means of external handle.

F. Interlock: Prevents access to switch interior except when in “off” position.

G. Fuse Clips: Rejection type.

H. Padlocking Provisions: For two (2) padlocks, whether open or closed.

I. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting where indicated.

J. Enclosure for Switchboard Mounting: Provide individual mounting where indicated.

K. Enclosure for Independent Mounting: NEMA Type 0 as indicated or required to suit environment where located, except all outdoor areas and all indoor environmentally harsh locations such as wastewater process areas shall be NEMA 4X stainless steel.

2.03 FUSED POWER CIRCUIT DEVICES

A. Manufacturers:

1. Pringle Electric Mfg. Co.

2. Square D Co.
 3. Or equal.
- B. UL 977, with either bolted-pressure-type or high-pressure contact-type switch.
- C. Operation: As indicated.
- D. Ground Fault Protection: Integral, self-powered type with mechanical ground fault indicator, test function, adjustable pick-up current and delay time with inverse and constant time characteristics, internal memory arranged to integrate intermittent arcing ground faults, and ground fault current sensor located as indicated.
- E. Open Fuse Trip Device: Arranged to trip switch open if phase fuse opens.
- F. Enclosure for Switchboard Mounting: Suitable for individual mounting.
- G. Enclosure for Independent Mounting: NEMA Type 1 enclosure, as indicated or as required to suit environment where located.
- H. Minimum Fault Current Rating: As indicated.

2.04 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers:
1. Square D Co.
 2. General Electric
 3. Eaton Corp.
 4. Or equal.
- B. UL 489 and NEMA AB 1.
- C. Construction: Bolt-in type, except breakers in load-center-type panelboards and breakers 225-ampere frame size and larger may be plug-in type if held in place by positive locking device requiring mechanical release for removal.
- D. Characteristics: Indicated frame size, trip rating, number of poles, and short-circuit interrupting capacity rating of 10,000 amperes symmetrical, unless greater rating is indicated on Drawings.

- E. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole. All service or feeder breakers to have removable trip plug, to have adjustable overcurrent trip, or to be electronic adjustable type.
- F. Adjustable Instantaneous Trip Devices: Factory adjusted to low-trip-setting current values.
- G. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting in switchboard or panelboards where indicated.
- H. Enclosure for Switchboard or Motor Control Center Mounting: Provide individual mounting where indicated.
- I. Enclosure for Independent Mounting: NEMA 4X stainless steel outdoor or damp environments, NEMA 1 stainless steel indoor enclosures, as indicated or required to suit environment where located. Handle operator mechanisms shall be on side of enclosure and not on front. Keyed mechanisms that separate handle from breaker mechanism when door is opened are not acceptable.
- J. Combination Circuit Breakers and Ground-Fault Circuit Interrupters: UL 943 arranged for sensing and tripping for ground-fault current in addition to overcurrent and short-circuit current.
 - 1. Match features and module size of panelboard breakers and provide clear identification of ground fault trip function.
 - 2. Trip Setting for Ground Fault: 4 to 6 milliamperes, listed and labeled as Class A, Type 1 device.
 - 3. Trip Setting for Ground Fault: 30 milliamperes.
- K. Current-Limiting Circuit Breakers: Arranged to limit let-through ampere-squared-seconds during fault conditions to value less than ampere-squared-seconds of one-half-cycle wave of prospective symmetrical fault current. Circuit breaker shall use no fusible devices in its operation. Current-limiting characteristic shall be in addition to normal time-delay and instantaneous-trip characteristics and other features as indicated.
- L. Circuit Breakers With Solid-State Trip Devices: Provide indicated circuit breakers with solid-state trip devices having following features:
 - 1. Ambient Compensation: Trip device insensitive to temperature changes between minus 20°C and plus 55°C.

2. Adjustability: Breaker ratings and trip settings shall be changeable by operation of controls on front panel of breaker, by change of plug-in element without removing breaker from mounting, or by combination of two methods.
 3. Ground-Fault Tripping: Adjustable for pick-up and time-delay values. Provide for indicated units.
 4. Provide clear plastic shield limiting access to rating plug and adjustments on solid-state trip circuit breaker. Seal by attaching sealing wire through hole in posts provided. With wire seal installed, circuit breaker rating plug and adjustments shall not be "readily accessible."
- M. For all electronic breakers requiring programming unit for trip adjustments provide one (1) unit for Owner and Engineers use in setting adjustments after contract ends. This unit to be supplied in new box with all appurtenances included. Submit unit to Engineer for examination prior to final acceptance testing of equipment.
- N. **Provide auxiliary contacts on all motor circuit protectors (MCP), motor starter circuit breakers, motor starter overloads, solid state starters, variable speed drive units, MCC feeder breakers, main service breaker, generator main breaker, low voltage transformer primary breakers and other breakers shown with trip units on one-line diagram to show tripped condition. Route trip circuits to solid state controller, SCADA, pump controller, and autodialer inputs for alarm initiation and annunciation. Coordinate with all equipment, MCC, control panel and SCADA suppliers and, with programmers.**

2.05 INSULATED-CASE CIRCUIT BREAKERS

- A. Manufacturers:
1. Square D Co.
 2. General Electric
 3. Or equal.
- B. UL 489 and NEMA AB 1.
- C. Ratings: Continuous-current, interrupting, and short-time-current ratings, and voltage and frequency ratings as indicated.
- D. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with following features:

1. Moving Contacts Closing Speed: Independent of both control and operator.
- E. Circuit-Breaker Trip Devices: Solid-state overcurrent trip device system that includes one (1) integrally mounted current transformer or sensor per phase, release mechanism, and following features:
1. Functions: Long-time-delay, short time delay, and instantaneous-trip functions, which are independent of each other in both action and adjustment.
 2. Temperature compensation to assure accuracy and calibration stability from minus 20°C to plus 55°C.
 3. Field-adjustable, time-current characteristics.
 4. Current Adjustability: Effected by operating controls on front panel or by changing plug-in elements or current transformers or sensors.
 5. Three bands for long-time- and short-time-delay functions marked "minimum," "intermediate," and "maximum."
 6. Five (5) pickup points, minimum, for long-time- and short-time-trip functions.
 7. Six (6) pickup points, minimum, for instantaneous-trip functions.
 8. Ground fault protection with at least three (3) short-time-delay settings and thirty-seven (37) trip-time-delay bands. Adjustable current pickup.
 9. Trip Indication: Labeled lights or mechanical indicators on trip device shall indicate type of fault causing breaker trip. If lights are used, integral power source shall maintain indication for 60 hours, minimum.
- F. Auxiliary Contacts for Remote Indication: Where remote indication of breaker position is indicated, provide spare auxiliary switch in addition to other auxiliary switches required for normal breaker operation. Spare auxiliary switch shall consist of two (2) Type "a" and two (2) Type "b" stages (contacts), wired to terminal block in breaker housing.

- G. Provide auxiliary contacts on all motor circuit protectors (MCP), motor starter circuit breakers, motor starter overloads, solid state starters, variable speed drive units, MCC feeder breakers, main service breaker, generator main breaker, low voltage transformer primary breakers and other breakers shown with trip units on one-line diagram to show tripped condition. Route trip circuits to solid state controller, SCADA, pump controller, and autodialer inputs for alarm initiation and annunciation. Coordinate with all equipment, MCC, control panel and SCADA suppliers and, with programmers.**
- H. Draw Out Features: Circuit-breaker mounting assembly equipped with racking mechanism that properly positions power circuit breaker and holds it rigidly in connected, test, and fully disconnected positions and includes following features:
1. Interlock arrangement, preventing movement of circuit breaker to or from connected position when it is in closed position and closure of circuit breaker unless it is in connected, test, or disconnected position.
 2. Construction, permitting racking open circuit breaker to or from connected, test, and disconnected positions with associated compartment door closed or equivalent dead-front barrier protection, and manual withdrawal to position for removal from structure with door open.
 3. Primary disconnecting devices disengaged and secondary disconnecting devices engaged when breaker is in test position.
 4. Primary and secondary devices disengaged when circuit breaker is in disconnected position.
 5. Ground contact engaged when circuit-breaker element is in connected and test positions.
- I. Circuit-Breaker Features and Accessories: Includes the following:
1. Padlocking Provisions: For installing at least two (2) padlocks on each breaker to secure its enclosure and prevent movement of draw out mechanism.
 2. Operating Handle: Provide one (1) for each manually operated breaker. No handle ties are permitted.
 3. Electric Close Button: Provide one (1) for each electrically operated breaker.
 4. Indicating Lights: Contacts for "Breaker Open" and "Breaker Closed," for main and bus tie circuit breakers, and for other indicated breakers.

2.06 OCPD ACCESSORIES

- A. Key Interlocks: Arrange interlocking so keys are held captive at devices indicated. Where future key interlocking provisions are indicated, provide necessary mountings and hardware as required for future installation.
- B. Instantaneous Undervoltage Trip Device: For indicated OCPD's.
- C. Adjustable-Time-Delay Undervoltage Trip Devices: For indicated OCPD's.
- D. Shunt-Trip Devices for Circuit Breakers: Where indicated, arrange to trip breaker from external source of power through control switch or relay contacts.
- E. For all electronic breakers requiring programming unit for trip adjustments provide one (1) unit for Owner and Engineers use in setting adjustments after contract ends. This unit to be supplied in new box with all appurtenances included. Submit unit to Engineer for examination prior to final acceptance testing of equipment.
- F. All service and feeder breakers to have removable trip plug, to have adjustable overcurrent trip, or to be electronic adjustable type.

2.07 SPARE FUSE CABINET - (WHERE INDICATED)

- A. Cabinet: Wall-mounted, 18 gauge minimum steel unit with full-length, recessed piano-hinged door with key coded cam lock and pull.
- B. Size: Provide for orderly storage of all spare fuses of this project plus 15% spare capacity, minimum.
- C. Finish: Gray baked enamel.
- D. Cabinet Door: Bear legend in stenciled 1 ½ inch high letters, "Spare Fuses."

2.08 ENCLOSURES

- A. Where OCPD's are installed in enclosures. Provide for operating via external lockable three (3) point latching handle without removing a cover or a bolted-on plate. Lockable hinged door access is acceptable where approved by Engineer or where required by enclosure classification. All outdoor enclosures to be NEMA 4X stainless steel unless specifically show otherwise on plans or approved by Engineer in writing.

2.09 MOTOR CIRCUIT PROTECTION (MCP)

- A. Provide electronic type MCP for motor starters. Unit shall learn inrush current and adjust accordingly.

2.10 LOAD SIZE CONNECTIONS

- A. Where OCPD serves as an incoming service main breaker or switch, include provisions for fixture connection of transfer switch conductor lugs. Provide removable bus bars. Provide adequate wiring space inside enclosure.

PART 3 EXECUTION

3.00 INSTALLATION

- A. Fuses: Install fuses in fusible devices indicated.
- B. Independently Mounted OCPD's: Locate as indicated and install in accordance with manufacturer's written installation instructions.
- C. Factory install OCPD's furnished in distribution equipment.
- D. Coordinate size overcurrent protective devices with each motor and equipment manufacturer to assure correct size devices and provide accordingly.

3.01 APPLICATION OF FUSES

- A. Control Circuits: Class CC, time delay.
- B. General Purpose Fusible Switches: Apply following class and types:
 - 1. 30-600 Amperes: Class J or RK1, time delay.
 - 2. 601-6,000 Amperes: Class L, time delay.
 - a. Size at 125% of motor FLA not to exceed 150%.
 - b. For transformers, size per NEC Table 450-3(b).
 - c. Size at 100% of load for mains and feeders with non-inductive loads.
- C. Combination Starters: Class J or RK1, time delay.

- D. Bolted Pressure Switches: Class L, time delay.

3.02 IDENTIFICATION

- A. Identify with components as specified in Section 16195 – “Electrical Identification.”

3.03 CONTROL WIRING INSTALLATION

- A. Install wiring between OCPD’s and control/indication devices as specified in Section 16120 – “600 Volt Building Wire and Cable” for hard-wired connections.

3.04 CONNECTIONS

- A. Check connectors, terminals, bus joints, and mountings for tightness.
- B. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.05 GROUNDING

- A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.
- B. Ground in accordance with Section 16452 – “Grounding.”

3.06 COORDINATION STUDY

- A. Provide coordination study to determine settings for overcurrent protective devices. Where coordination study recommends changes in types, classes, features or ratings of equipment or devices those indicated, make written request for instructions. Obtain instructions from Engineer before ordering equipment or devices recommended to be changed. Make all settings and adjustments according to coordination study results. Provide hard copy records of study for Engineer’s review.

3.07 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services:
 - 1. Manufacturer's Technician for equipment specified herein shall be present at job site for assistance during plant startup, equipment adjustment, and training of Owner’s personnel for plant operation.

2. Factory Technician shall make all adjustments and settings.
3. Manufacturers Technician shall be for final acceptance and testing and shall demonstrate equipment operation to Engineer and Owner's Representative.

B. Testing:

1. Reports: Prepare certified written reports on tests and observations. Report defective materials, workmanship, and unsatisfactory test results. Include complete records of repairs and adjustments made.
2. Labeling: Upon satisfactory completion of tests and related effort, apply label to tested components indicating test results, date, and responsible person.
3. Schedule visual and mechanical inspections and electrical tests with at least one (1) week's advance notification.
4. Pre-testing: Upon completing installation of system, perform following preparations for tests:
 - a. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
 - b. Make continuity tests of circuits.
 - c. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
 - d. Comply with manufacturer's instructions for installation and testing of OCPD's.
5. Visual and mechanical inspection: Include following inspections and related work.
 - a. Overcurrent Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make final system adjustments.
 - b. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.

- c. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - d. Check tightness of electrical connections of OCPD's with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - e. Clean OCPD's using manufacturer's approved methods and materials.
 - f. Verify installation of proper fuse types and ratings in fusible OCPD's.
6. Electrical Tests: Include following items performed in accordance with manufacturer's instructions:
- a. Insulation resistance test of OCPD conducting parts. Insulation resistance less than 100 megohms is not acceptable.
 - b. Verify trip unit reset characteristics for insulated-case circuit breakers.
 - c. Make adjustments for final settings of adjustable-trip devices.
 - d. Activate auxiliary protective devices such as ground fault or undervoltage relays, to verify operation of shunt-trip devices.
 - e. Check stored-energy charging motors for proper operation of motor, mechanism, and limit switches.
 - f. Check operation of electrically operated OCPD's in accordance with manufacturer's instructions.
 - g. Check key and other interlock and safety devices for operation and sequence. Make closing attempts on locked-open and opening attempts on locked-closed devices including moveable barriers and shutters.
7. Retest: Correct deficiencies identified by tests and observations and retest. Verify by system tests that specified requirements are met.

3.08 CLEANING

- A. Upon completion of installation, inspect OCPD's. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 16476
DISCONNECTS AND CIRCUIT BREAKERS

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. **Fusible switches are allowed only where specifically shown on Plans for this project, or where approved in writing by Engineer.**

1.01 SUMMARY

- A. Section Includes:
 - 1. Service disconnects.
 - 2. Feeder and equipment disconnects.
 - 3. Enclosed circuit breakers

1.02 SUBMITTALS

- A. Submit the following for Engineer’s approval.
- B. Product Data:
 - 1. Submit for switches, circuit breakers, and accessories.
 - 2. Descriptive data and time-current curves for protective devices and let-through current curves for those devices with current-limiting characteristics. Include coordination charts and tables, and related data.
- C. Shop Drawings: Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.
- D. Test Results: Field test reports indicating and interpreting test results.

- E. Operating and Maintenance Data: Maintenance data for tripping devices
- F. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.
- G. Coordination: Contractor shall determine size, horsepower, voltage, and phase of all equipment and motors supplied and shall adjust breaker and fused switch size accordingly and shall note on submittals. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

1.03 QUALITY ASSURANCE

- A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
- C. Single-Source Responsibility: Enclosed switches and circuit breakers shall be product of single manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fusible Switches:
 - 1. Eaton
 - 2. Cutler-Hammer
 - 3. Siemens
 - 4. Or equal, as pre-approved in writing.

- B. Fused Power Circuit Devices:
 - 1. Eaton
 - 2. Boltswitch
- C. Molded-Case Circuit Breakers:
 - 1. Eaton
 - 2. Cutler-Hammer
- D. Combination Circuit Breaker and Ground Fault Trip:
 - 1. Eaton
 - 2. Cutler-Hammer
- E. Molded-Case Current-Limiting Circuit Breakers:
 - 1. Eaton
 - 2. Cutler-Hammer
- F. Other Manufacturers that are pre-approved in writing.

2.02 ENCLOSED SWITCHES

- A. Enclosed Non-fusible Switch: NEMA KS 1, Type HD handle lockable with 2 padlocks
- B. Enclosed Fusible Switch, 800 Amperes and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with two (2) padlocks, and interlocked with cover in CLOSED position.
- C. Enclosed Fusible Switch Larger Than 800 Amperes: Bolted-pressure or high-pressure contact switch, bus drilled to accommodate specified fuses, enclosure consistent with environment where located.
 - 1. Minimum Fault Current Rating: 100,000 symmetrical rms amperes.
- D. All enclosures located outdoors or where subject to wet or environmentally harsh locations shall be NEMA 4X 316 stainless steel.
- E. All switches shall be rated at 600 volts minimum.

- F. Handle operator mechanisms shall be on side of enclosure and not on front. Keyed mechanisms that separate handle from breaker mechanism when door is opened are not acceptable.

2.03 ENCLOSED CIRCUIT BREAKERS

- A. Enclosed Molded-Case Circuit Breaker: NEMA AB 1, handle lockable with 2 padlocks
- B. Characteristics:
 - 1. Frame size, trip rating, number of poles, and auxiliary devices as indicated
 - 2. Interrupting capacity rating to meet available fault current, 10,000 symmetrical rms amperes minimum
 - 3. Appropriate application listing when used for switching fluorescent lighting loads or heating, air conditioning, and refrigeration equipment.
- C. All enclosures located outdoors or where subject to wet or environmentally harsh locations shall be NEMA 4X 316 stainless steel.

2.04 ACCESSORIES

- A. Solidstate breaker requiring programming unit for settings adjustment
 - 1. Provide new programming unit and all accessories for Owner and Engineers use. Turn over to Engineer for review and testing.
 - 2. Original set-up and adjustments shall be performed by the Circuit Breaker Manufacturers Factory Representative.

2.05 TRIP UNITS

- A. All service and feeder breakers to have replaceable trip plugs, or be adjustable (load current), or be electric type with adjustable trips.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install enclosed switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.

- B. Install enclosed switches and circuit breakers level and plumb.
- C. Install wiring between enclosed switches and circuit breakers and control/indication devices.
- D. Connect enclosed switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Supplier's or manufacturer's representative for equipment specified herein shall be present at job site or for assistance during plant construction, plant startup, and training of Owner's personnel for plant operation.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.5 for enclosed switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.
- C. Training:
 - 1. Train Owner's maintenance personnel on procedures and schedules for startup and shutdown, troubleshooting, servicing, and preventive maintenance.
 - 2. Review operating and maintenance data.

3.03 ADJUSTING

- A. Set field-adjustable enclosed switches and circuit breaker trip ranges as indicated.

3.04 CLEANING

- A. After completing system installation including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION

SECTION 16482

MOTOR CONTROL CENTERS (600 VOLTS OR LESS)

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work”, Item 1.04 – “Submittals” for submittal requirements.
- D. Listing of acceptable Equipment Manufacturers does not limit or remove the intent of these specification requirements.**
- E. Provide Power Analysis and Coordination Study using current version of ETAP. Conduct Arc Flash studies and provide Arc Flash warning signs per NEC.

1.01 SUMMARY

- A. Section Includes: Motor Control Centers (MCC’s) for use on ac circuits rated 600 volts or less.
- B. Overcurrent protective devices and disconnect switches used with motor control centers (MCC’s) are specified in Section 16475 – “Overcurrent Protective Devices.”
- C. See Section 16012 – “Electrical Work,” Item 2.01 – “Materials” UL fabrication requirements and Section 16012 – “Electrical Work,” Item 1.04 – “Submittals” for additional submittal requirements.

1.02 REFERENCES

- A. American National Standards Institute (ANSI): ANSI C2-90 - National Electrical Safety Code (NEC).

- B. International Electrical Testing Association (P.O. Box 687, Morrison, CO 80465): ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA 250-89 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA ICS 2-88 - Industrial Control Devices, Controllers, and Assemblies.
 - 3. NEMA ICS 2.3-88 - Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers.
- D. Underwriters Laboratories (UL):
 - 1. UL 486A-89 - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 - 2. UL 845-89 - Motor Control Centers.

1.03 SUBMITTALS

- A. Submit the following for Engineer's approval.
- B. Shop Drawings:
 - 1. Each MCC including dimensioned plans and elevations and component lists.
 - 2. Show ratings, including short-time and short-circuit ratings, and horizontal and vertical bus ampacities.
 - 3. Schedule of features, characteristics, ratings, and factory settings of individual MCC units.
 - 4. Wiring Diagrams: Interconnecting wiring diagrams pertinent to class and type specified for MCC. Schematic diagram of each type of controller unit indicated.
 - 5. Dimensioned floor plans with MCC location and required stub-up entries into MCC. Show all pertinent dimensions that verify MCC fits space allocated on plans. Identify areas where equipment fit is a problem and describe any proposed solutions. All equipment shall be fabricated to fit available space shown.

- C. Product Data: Each product and component included in MCC (such as VFD) that is described in other specification sections shall be submitted separately or under the MCC cover, and with applicable specification section marked according to requirements of item F below. Submittals received that are incomplete will be returned without review.
- D. Test Results: Certified reports of field tests and observations.
- E. Operations and Maintenance Data: Maintenance data for MCC's.
- F. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.
- G. Provide one-line diagram with MCC submittal showing actual horsepower of motors to be provided for this project. Do not rely solely on plans but rather, coordinate with other vendors providing motors and equipment. Failure to do so will be at Contractor's expense and at no additional cost to Owner.
- H. All submittals for motor control centers, control panels, control sections, SCADA panels, lift pump panels, and Vendor furnished panels must contain statement of U.L. certification and identifying name and number of U.L. certification.

1.04 QUALITY ASSURANCE

- A. Items provided under this section shall be listed and labeled by UL or other nationally recognized Testing Laboratory (NRTL). This includes complete MCC and switchgear assembly, including controls section.
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code: Components and installation shall comply with NFPA 70.
- C. Manufacturer's Qualifications: Manufacturer shall be a member of NEMA, regularly engaged in manufacturing LV MCC's complying with requirements of these Specifications, and experienced with at least five (5) projects of similar size and scope.

- D. Product Selection for Restricted Space: Drawings indicate minimum dimensions for MCC's including clearances between MCC's and adjacent surfaces and items and are based on types and models indicated. MCC's of other manufacturers having equal performance characteristics and complying with indicated maximum dimensions may be considered.
- E. MCC starters, MCP, and breaker sizes shall be coordinated with motors supplied device and sizes shall be adjusted as required by motor criteria. This especially applies to high efficiency motors.

Provide motor data to MCC Manufacturer at time MCC is ordered to assure coordination of overcurrent protective devices.

- F. Final assembly and mating of control sections or motor control center section shall be performed at facilities within 200 miles of project location. The following final assembly facilities are acceptable:
 - 1. Weimar Manufacturing Co.
 - 2. B.L. Technology, Inc.
 - 3. W.W. Payton
 - 4. Ace Controls
 - 5. Texas Industrial Controls Manufacturing (TICM)
 - 6. Systems, Inc.
 - 7. Control Panel Manufacturers listed in other Specification Sections.

- G. Testing and Startup:
 - 1. All elements of each electrical control system shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification. All special testing of materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all testing and startup work with the Owner and Systems Integration Engineer. As a minimum, the testing shall include both a shop test and a field test by the Engineer.

2. **Factory Tests:** The electrical controls and all other associated hardware shall be tested via a full simulation at the factory or shop, prior to shipment, to demonstrate that each component is operational and meets the requirements of these specifications. Manufacturer shall provide test routine program for shop testing of I/O wiring. Test results shall be certified, with written documentation provided to the Engineer upon test completion. Shop testing may be witnessed by the Engineer, who will provide programming at time of testing.
3. **Field Tests:** All electrical control system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly. Witnessed field tests shall be performed on the complete system. General Contractor shall provide commission services for entire electrical system. Contractor shall provide a checklist for all electrical, control and instrumentation functions and send to Engineer for approval.

Each function shall be demonstrated to the satisfaction of the Owner and Engineer on a paragraph-by-paragraph basis. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion. The Contractor shall notify the Owner at least 2 weeks prior to the commencement date of the field tests. After tests are completed and with system fully operational, system shall run continuously for a period of 10 days without failure. Any failures shall be repaired and test shall start over again.

4. **Pump Controller Program:** Testing will require a minimum of 10 working days after programs are downloaded to the pump controller. Provide 4 weeks' notice for program downloading by Programmer. This shall be accounted for in project schedule.
 5. **Prior to testing system, or PLC programs or HMI programs provided by other than the Systems Integration Engineer shall be furnished on CD for review by Engineer. Provide any special software necessary to run and test complete program.**
- H. Provide MCC that fits space available. Where dimensions exceed available space, sections are to be relocated in room or, MCC shall be specifically manufactured for this project to accommodate the space restrictions at no additional cost to Owner. Contractor shall contact Engineer before ordering equipment or installing conduits where space restriction exists.
- I. Where controls section is fabricated by other than MCC Manufacturer, a matching controls sections shall be provided and shipped to controls fabrication shop at time MCC is ordered so as to expedite controls assembly.

- J. Cabinet and Enclosures Heights: Cabinet, panel, and enclosure heights shall not exceed 6 feet – 6 inches from floor to top fastening devices to allow access by Operator without use of ladders or steps to open enclosure doors.
- K. All equipment, instruments and devices provided for this project shall have means of protection from power line conditions such as surge, phase fail, or other line conditions that may damage equipment, instruments or devices furnished. It is vendors and manufacturers' responsibility to provide protective devices as required for maintaining warranty of furnished items and to assure no damage occurs from power line conditions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in shipping splits of lengths that can be moved past obstructions.
- B. Store so condensation will not occur on or in MCC's. Provide temporary heaters as required to prevent condensation.
- C. Handle MCC's in accordance with NEMA ICS 2.3, "Instructions for Handling, Installation, Operation, and Maintenance of Motor Control Centers." Use factory-installed lifting provisions.

1.06 MAINTENANCE

- A. Extra Materials:
 - 1. Spare Fuses: Furnish one spare for every five of each type and rating of fuse and fusible devices installed, but not less than one set of three of each kind. Include spares for:
 - a. Control power circuit breakers.
 - b. Fuses and fusible devices for fused circuit breakers. (Where fuses approved.)
 - c. Fuses for fusible switches. (Where fuses approved.)
 - 2. Spare Indicating Lights: Furnish five of each type installed.
 - 3. Touch-Up Paint: Furnish three (3) half-pint unopened containers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton
- B. Cutler-Hammer
- C. Siemens
- D. Square D.
- E. General Electric
- F. Or equal, as pre-approved in writing before bid date.

2.02 MOTOR-CONTROL CENTERS

- A. Wiring Classification: Class I, Type B, as defined in NEMA ICS 2.
- B. Enclosure: NEMA Type 1, gasketed, as defined in NEMA 250, except as otherwise indicated.
- C. Compartments:
 - 1. Modular, with individual doors with concealed hinges and quick-captive screw fasteners.
 - 2. For combination starter units provide interlocks so disconnect means must be in off position before door can be opened and so door cannot be closed with disconnect means in on position, except by consciously operating permissive release device. Rotating type operators located outside of door are not acceptable.
- D. Interchangeability:
 - 1. Construct compartments so it is possible to remove units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in control center.
 - 2. Units requiring same size compartment shall be interchangeable, and compartments shall be constructed to permit ready rearrangement of units such as replacing three single units with unit requiring three spaces without cutting or welding.

- E. Wiring Spaces:
 - 1. Provide each vertical section of structure with horizontal and vertical wiring spaces for wiring to each unit compartment in each section.
 - 2. Provide separate door over vertical wiring space.
 - 3. Provide supports to hold wiring rigidly in place.
- F. Meet current NEC requirements for service entrance.
- G. Ratings: Provide nominal system voltage, continuous main bus amperage, and short time and short-circuit-current ratings as indicated and conform to short circuit and coordination study.
- H. All enclosures for motor starters 100 hp and greater shall have forced air cooling. All outdoor enclosures are to have sufficient forced fan cooling. Provide rain hood, intake louvers, insect screens and fan motor circuits with t-start “On/Off” controls.
- I. Unless specifically noted or shown on plans, all outdoor MCC’s shall be NEMA 4X stainless steel with three (3) point latching doors. Indoor enclosures shall be NEMA 1, unless shown otherwise on plans. Where NEMA 1 enclosure is installed outdoors in a NEMA 3R or 4X outer enclosure, the inner NEMA 1 enclosure shall be independently fabricated and installed, separate from the outer enclosure such that the outer enclosure may be replaced without disturbing the inner enclosure in any manner.
- J. All outdoor enclosures shall have means of cooling and/or ventilation where environmental temperatures exceed any internal device ratings.
- K. All step-in or walk-in enclosures shall have adequate ventilation for cooling.
- L. Door Restraints: Provide door restraints on all doors for outdoor enclosures.
- M. All MCC sections to have 120-volt space heater with t-stat.
- N. All connections to devices and controls external to MCC shall be made at terminal strips on blocks only. Direct connection to MCC devices is prohibited.
- O. Door latches shall not be operated with hex head type screws. Flat blade screwdriver shall be able to open latches.
- P. Provide enclosed type fluorescent light fixture in each MCC section. Install switch at location shown on Plans.

2.03 BUSES

- A. Material: Tin plated copper.
- B. Ampacity Ratings: As indicated for horizontal main buses and vertical bus sized for indicated loads or 300A minimum.
- C. Neutral Buses: Full size.
- D. Equipment Ground Bus: Non-insulated, horizontal copper bus 2 inches by ¼ inch, minimum.
- E. Horizontal Bus Arrangement: Extend main phase, neutral and ground buses with same capacity entire length of MCC unless otherwise indicated, and provision for future extension at both ends by means of bolt holes and captive bus splice sections or approved equivalent.
- F. Natural Disconnect Link: For switchgear assembly having main service disconnect. Arrange to permit disconnecting the switchgear assembly neutral bus from the common ground bus and the incoming service neutrals. Also, provide a bolted, un-insulated, ¼ inch x 2 inch copper bus (main bonding jumper). Arrange to interconnect the neutral and the ground buses to establish the system common ground point.
- G. Short-Circuit Withstand Rating: Same as short-circuit current rating of section.
- H. Current transformers shall be mounted with factory brackets in line with bus bar or conductor routing. Provide warning label to deactivate power to MCC before attempting service to C.T.

2.04 FUNCTIONAL FEATURES

- A. General: Provide modular arrangement of motor controllers, control devices, overcurrent protective devices, transformers, panelboards, instruments, indicating panels, blank panels, and other items mounted in compartments of motor-control center as indicated.
- B. Motor Controller Units:
 - 1. Combination controller units; of types and with features, ratings, and circuit assignments indicated.

2. Units with full-voltage, across-the-line, magnetic controllers up to and including Size 3 shall be installed on drawout mountings with connectors that automatically line up and connect with vertical section buses while being racked into their normal energized positions.
 3. Units shall have short-circuit current ratings equal to or greater than short-circuit current rating of MCC section.
 4. Units in MCC's shall be equipped with pull-apart terminal strips or drawout terminal boards for external control connections.
 5. All autotransformer type start installation shall be coordinated with power factor capacitors to avoid resonant conditions that might produce harmonics.
 6. All autotransformer type starters to have temperature sensor devices. Connect to controls to protect autotransformer from over-temperature.
 7. All well and blower motor starters to have start time delay relay.
 8. Contactor shall include minimum of four single pole, double throw spare auxiliary contacts rated at 10 amperes continuous, for each starter furnished.
- C. Overcurrent Protective Devices:
1. Provide types of devices with features, ratings, and circuit assignments indicated, as specified in Section 16475 – “Overcurrent Protective Devices.”
 2. Individual feeder tap units through 225 ampere rating shall be installed on drawout mountings with connectors that automatically line up and connect with vertical section buses while being racked into their normal energized positions.
 3. All equipment feeder and/or motor circuit breakers (not MCP) are to have plug-in trip unit.
 4. Motor Circuit Protectors (MCP) shall be electronic type that learn inrush current and adjust accordingly.
- D. Overload Relays:
1. Ambient-compensated type with inverse-time-current characteristic.

2. Provide with heaters or sensors in each phase matched to nameplate full load current of specific motor to which connected with appropriate adjustment for duty cycle. Overload devices to require manual reset after tripping occurs. Provide trip relay and provide signal circuit to PLC, SCADA, autodialer or annunciator to indicate trip signal.
 3. Enhanced Protection Overload Relay: Provide overload relays with NEMA Class 10 tripping characteristics for submersible equipment or where indicated. Select to protect motor against voltage unbalance and single phasing.
 4. Select overload heaters and relays based on Motor Manufacturer's requirements, or based on motor nameplate data, size at 1.15 FLA (nameplate). Measure actual FLA in operation and provide data in O&M Manual. Where overloads trip during normal operation, provide current recordings to analyze cause and time of events, and provide data to Engineer for recommended corrective action.
- E. Coordinate size of circuit breakers, trip units, MCP's and other overcurrent protective devices, with motor manufacturer's and provide proper rated devices accordingly.
- F. Spaces and Blank Units: Compartments fully bussed and equipped with guide rails or equivalent, ready for insertion of drawout units.
- G. Spare Units: Type, sizes, and ratings as indicated, and installed in compartments indicated "spare."
- H. All motor starter controls are to include ETM, HOA, start time delay relay, and Run light as a minimum. Controls shall have HOA switch and circuits that allow automatic restart of controls after momentary power interruption, without rest action required. Lock-in push button controls are not allowed. Provide time delay for restart.
- I. Control Diagrams: Provide complete and accurate control diagrams and one-line diagram laminated in clear plastic and installed in door pockets of motor control center.
- J. All control transformers shall be sized for 250 percent of full load. **Provide CPT with 120V secondary and primary circuit breakers. CPT to be rated at minimum of 500VA providing 350VA capacity for loads above controller requirements. Provide secondary circuit breakers for controls and other devices indicated on plans. Do not feed motor heater circuits from starter CPT power source.**
- K. All display screens or readouts shall be mounted in panel at height of 60 inches above level where operator stands. This must be accounted for where panels are installed on concrete pads or other elevated structures.

- L. Inhibit Relays: Where generator is not designed to carry full load of motors, provide inhibit relay for each motor starter over 5 horsepower to inhibit motor starter operation when generator runs. Relay is to be energized by generator run signal from ATS or generator. Provide bypass switch across the inhibit relay contacts to allow selected motors to run on generator power.
- M. Provide one (1) additional auxiliary contact for each motor starter.
- N. Where standard MCC controls section shown on Plans will not contain all devices on backplate, provide additional plate hinged to side of section wall for mounting additional devices. Space location to all clearance from devices on backplate.
- O. Manufacturer to provide all controller addresses, HMI and OIU templates and other data pertinent to SCADA programming by Engineer. No exceptions.
- P. All control device settings are to be adjusted by Contractor for values recommended by the Plant Operator. Contract Engineer for clarifications.
- Q. Controls – Trouble, Failure and Status Indications
 - 1. Control circuit devices shall have auxiliary contacts to indicate position, alarm and status for annunciating a control circuit string condition at any specific time. This string shall include all devices from start of diagram such as HOA switch, control devices, alarm devices, status devices, motor starters, overload relays and circuit breakers, which shall all have status or alarm contacts. Provide circuits from each inputs of PLC controller, SCADA, autodialer or annunciation equipment. This requirement is to allow operator to immediately identify any device or function that may prevent proper operation of electrical system equipment. Refer to control diagrams in places for typical control circuits.

2.05 IDENTIFICATION PRODUCTS

- A. Provide identifying devices.
- B. Equipment Markers: Provide 2-ply, 1/8-in. thick laminated plastic, engraved equipment markers.
 - 1. Color: Black letters on white background.
 - 2. Nomenclature: Include following, matching terminology on schedules as closely as possible:

- a. Equipment name (i.e. motor control center).
 - b. Equipment Tag No. (i.e. 30-MCC-1).
 3. Size: Provide approximate 3-in. by 6-in. (minimum) for equipment.
 - a. 1-in. high letters for equipment tag number.
 - b. 1/2-in. high letters for descriptive equipment name.
 4. Size: Provide approximate 1 ½ inch by 3 inch (minimum) for device or component.
 - a. ¼ inch high letters for equipment tag number.
 - b. ¼ inch high letters for descriptive equipment name.
 5. Fasteners: Self-tapping stainless steel screws except contact type permanent adhesive where screws cannot or should not penetrate substrate.
- C. Wire Markers: Provide wire markers for all power and control wiring. Install at points where wire terminates at devices and terminal strip.
- D. Place wire identification tags at each end of all conductors.
- 2.06 FINISHES
- A. Manufacturer's standard finish suitable for environment in which installed.
- 2.07 CONCRETE BASES
- A. Class "B" as specified in Part 3 – "Execution."

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install MCC's in accordance with NEMA ICS 2.3 "Instructions for Handling, Installation, Operation, and Maintenance of MCC's," and with manufacturer's written installation instructions.

- B. Anchor each motor-control center assembly to concrete base in accordance with manufacturer's recommendations. Level and grout sills flush with motor-control center mounting surface.
- C. Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from MCC units and components.
- D. Install separate independent anchor bolts for NEMA 1 enclosure where based outdoors with an outer enclosure. Outer enclosure shall be removable without disturbing inner enclosure, as described in Item 2.02 – “Motor Control Centers.”
- E. All components inside enclosures shall be fastened down with proper hardware. All cables shall be bundled and bound with waxed cord or nylon tie-raps manufactured for that purpose. Adhesive tie down blocks are not allowed. Provide threaded press-in or welded studs for nylon cable clamps as required.
- F. Contractor shall coordinate all conduit stub-ups into MCC. Any mis-located conduits shall be relocated at Contractor’s expense and at no additional cost to Owner.
- G. All motor control centers shall be fabricated to fit space available as shown on plans, even when special fabrication is required.
- H. Stub up all conduits entering MCC’s, and other equipment enclosures from the bottom into each respective starter, feeder breaker or control section per equipment manufacturers conduit layout detail. Coordinate with equipment manufacture data sheets before starting any underground or below slab conduit installations.

3.02 CONCRETE BASES

- A. Provide 4-inch high concrete foundation on pad under MCC or as shown on plans.

3.03 LOCKOUT TAG OUT STATION

- A. Provide and install wall mounted enclosed padlock storage module with hinged door. Module shall have 8 hooks, each capable of holding 2 locks. Provide 8 safety locks and tags. Provide sign on door. Brady or equal quality Manufacturer. Identify field-installed wiring and components and provide warning signs, as specified in Section 16195 – “Electrical Identification.”

3.04 CONNECTIONS

- A. Tighten MCC bus joint bolts, electrical connector, and terminal bolts in accordance with Manufacturer's installation instructions and torque-tightening values. Where manufacturer's torque values are not stated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's technician for equipment specified herein shall be present at job site or classroom designated by Owner for minimum of 2 workdays, travel time excluded, for assistance during plant startup, equipment adjustment, and training of Owner's personnel for plant operation. Include minimum of:
 - a. Two (2) person-days for Instructional Services.
2. Supplier or Manufacturer shall direct services to specific system and equipment operation, maintenance, and troubleshooting.

B. Testing:

1. Comply with applicable requirements of InterNational Electrical Testing Association (INETA) Standard ATS, "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems."
2. Reports: Notify Engineer in writing indicating defective materials and workmanship and unsatisfactory test results. Include record of repairs and adjustments made.
3. Perform following tests:
 - a. Test insulation resistance of MCC buses; components; and of connecting supply, feeder, and control circuits. For components with solid-state devices or other sensitive components, perform tests in accordance with manufacturer's instructions.
 - b. Make continuity tests of circuits.
 - c. Inspect MCC's for defects and physical damage, testing laboratory labels, circuit connections, and nameplate compliance with up-to-date system drawings.

- d. Perform operational test and exercise of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - e. Check MCC anchorage, external clearances, and alignment and fit of components including internal elements.
 - f. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - g. Perform visual and mechanical inspection and related work for motor control and protective devices.
 - h. Device Ratings and Settings: Verify ratings and settings of overload relays, motor circuit protectors, and overcurrent protective devices.
4. Quality Control Testing Program: Assure MCC installation meets specified requirements, is operational within specified tolerances, and provides appropriate protection for systems and equipment.
- a. Test and inspect MCC's in accordance with manufacturer's recommendations and these specifications.
 - b. Schedule tests and provide notification at least 7 days in advance of test commencement.
 - c. Reports: Prepare written reports of test results and observations. Report defective materials and workmanship. Include complete records of adjustments and corrective action taken.
 - d. Labeling: On satisfactory completion of tests and related effort, apply label to tested components indicating results, person responsible, and date.
 - e. Test insulation resistance of buses and portions of control wiring that disconnect from solid-state devices through normal disconnecting features. Insulation resistance less than 100 megohms is not acceptable.
 - f. Verify appropriate capacity, overcurrent protection, and operating voltage of control power elements including control power transformers and control power wiring.
 - g. Check phasing of supply source to bus.
 - h. Test motor-control devices.

- i. Test overcurrent protective devices.
 - 5. Retesting: Correct deficiencies and retest. Verify by retests that specified requirements are met.
- 3.06 CLEANING
 - A. Inspect interior and exterior of MCC's. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- 3.07 PROTECTION
 - A. Temporary Heating: Apply temporary heat in accordance with manufacturer's recommendation within each section of switchgear throughout periods during which the switchgear is not in a space that is continuously under normal control of temperature and humidity.
- 3.08 WARRANTY
 - A. Contractor shall provide full 3-year service warranty on the overall installation and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written "Final Acceptance" of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor's warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed.

Where Manufacturer's products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its affect on the product. Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor's expense and at no additional cost to the Owner.

- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.
- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

3.09 TRAINING

- A. Provide minimum eight (8) hours of “hands-on” instruction each for Owner’s staff. To be conducted at project site by control systems manufacturer’s representative, at no additional cost to Owner. Training is to be conducted after all control systems are fully operational. To include PLCs and other devices. See Section 16012 – “Electrical Work” for additional requirements and refer to other equipment
- B. Provide minimum two (2) weeks notice to Engineer and Owner before conducting training.

END OF SECTION

**SECTION 16484
ELECTRONIC SOFT-START CONTROLLERS**

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work”, Paragraph 1.04 – “Submittals” for submittal requirements.
- D. Listing of acceptable Equipment Manufacturers does not limit or remove the intent of these specification requirements.**

1.01 SCOPE

- A. This specification describes the electrical, mechanical, and reliability requirements for three phase, electronic soft-start starters (controllers) with full voltage non-reversing (FVNR) bypass contactor as specified herein and as shown on the contract drawings.

1.02 RELATED SECTIONS

- A. Division 16 – “Electrical” that apply to the requirements of this project.

1.03 REFERENCES

- A. The electronic soft-start controllers and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of IEC, UL, and NEMA.

1.04 SUBMITTALS FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer.
 - 1. Dimensioned outline drawing.

2. Schematic diagram
 3. Component list.
 4. Power and control connection diagram(s)
- B. Submit six (6) copies of the above information.
- C. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.05 SUBMITTALS

- A. Submit all products covered under this section for Engineer’s approval.
1. Descriptive bulletins
 2. Product sheets
- B. See Section 16012 – “Electrical Work” for additional requirements.

1.06 SUBMITTALS-FOR CLOSEOUT

- A. The following information shall be submitted for record purposes prior to final payment.
1. Final as-built drawings and information for items listed section in 1.04.
 2. Installation information
- B. See Section 16012 – “Electrical Work” for additional requirements.

1.07 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

- C. Electronic soft-start controllers shall be equivalent to features of Cutler-Hammer type for function and quality. Products that comply with the specifications and manufactured by others are acceptable where pre-approved in writing.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUALS

- A. Six (6) copies of the equipment operation and maintenance manuals shall be provided.
- B. Operation and maintenance manuals shall include the following information:
 - 1. Step-by-step operation and maintenance instructions
 - 2. Recommended renewal parts list.
 - 3. Drawings and information required by Paragraph 1.06.
 - 4. Comply with O&M requirements of Section 16012 – “Electrical Work.”

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton
- B. Cutler-Hammer
- C. Siemens
- D. Or equal, pre-approved, in writing

2.02 SOLID-STATE REDUCED VOLTAGE MOTOR CONTROLLER REQUIREMENTS

- A. Electronic Soft-Start Controller with FVNR bypass.

1. The solid-state reduced voltage starter shall be UL and NEMA listed. The solid state reduced voltage controller shall be an integrated unit with power SCR's, heat sink, logic board, paralleling bypass contactor, and electronic overload relay enclosed in a single molded housing.
2. A full voltage bypass and isolation contactor is to be provided in addition to the standard Run contactor. Bypass contactor is to be NEMA rated and UL listed to start motor across the line.
3. The SCR based power section shall consist of six (6) back-to-back SCR's and shall be rated for a minimum peak inverse voltage rating of 1600 volts PIV. The starter shall be three-phase, 60 Hz, and rated for the hp, current, and voltage as shown on the drawings.
4. Units shall include an integrated fan controlled by thermal sensors on the heat sink. Fan shall automatically operate during the start ramp and if internal temperature on the heat sink exceeds 60 degree C.
5. Units using triacs or SCR/diode combinations shall not be acceptable.
6. Resistor/capacitor snubber networks shall be used to prevent false firing of SCR's due to dv/dt effects.
7. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformally coated to protect environmental concerns.
8. The paralleling run bypass contactor shall energize when the motor reaches 90% of full speed and close/open under 1 times motor current.
9. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions.
10. Starter shall be provided with electronic overload protection as standard and shall be based on an inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via a DIPswitch setting on the device keypad. Overload device trip relay shall provide signal to PLC, SCADA, autodialer and annunciator to show tripped condition.
11. Overload protection shall be adjusted via the device keypad and shall have a motor full load amp adjustment from 30 to 100% (3.2:1) of the max continuous ampere rating of the starter.

12. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIPswitch setting on the device keypad.
13. Starter shall be capable of either an electronic or mechanical reset after a fault.
14. Units using bi-metal overload relays are not acceptable.
15. Overtemperature protection (on heat sink) shall be standard.
16. Starters shall provide protection against improper line side phase rotations as standard. Starter will shut down if a line side phase rotation other than A-B-C exists. This feature can be disabled via a DIPswitch on the device keypad.
17. Starters shall provide protection against a phase loss as standard. Starter will shut down if a 50% current differential between any two phases is encountered. This feature can be disabled via a DIPswitch on the device keypad.
18. Start shall provide protection against a motor stall condition during the start ramp as standard. This feature can be disabled via a DIPswitch on the device keypad.
19. Starter shall provide protection against a motor jam condition during run as standard. This feature can be disabled via a DIPswitch on the device keypad.
20. Starter shall be provided with a form C normally open (NO), normally closed (NC) contact that shall change state when a fault conditions exists. Contacts shall be rated 240V AC and 24V DC max, 3 amps as standard. In addition, an LED display on the device keypad shall indicate type of fault (Overtemp, Phase Loss, Jam, Stall, Phase Reversal, and Overload).
21. The following control function adjustments on the device keypad are required:
 - a. Selectable Torque Ramp Start or Current Limit Start
 - b. Adjustable Kick Start Time, 0-2 seconds
 - c. Adjustable Kick Start Torque, 0-85% (of LRT)
 - d. Adjustable Ramp Start Time; 0.5-180 second
 - e. Adjustable Initial Starting Ramp Torque; 0-85% (of LRT)
 - f. Adjustable Smooth Stop Ramp Time; 0-60 seconds.

22. Enclosed units shall include a thermal magnetic circuit breaker or HMCP for short circuit protection and quick disconnect means.
23. Starters and breakers/HMCP's are to rated per UL508D for a withstand rating of 65 kAIC rms unless shown greater on one-line diagram.
24. Units enclosed in motor control centers shall be of the same manufacturer as that of the circuit breaker and motor control center for coordination and design issues.
25. The Manufacturer of the solid-state starter shall employ a field based factory service organization for the purpose of startup and repair of units. (Third party service contractors are not acceptable.) Manufacturer's local distributor shall maintain a minimum stock of one of each model unit installed under this contract.
26. Maximum continuous operation shall be at 100% of continuous amp rating.
27. Control power shall be 24V DC as standard for safety and reliability. **In addition, provide CPT with 120V secondary and primary circuit breakers. CPT to be rated at minimum of 500VA providing 350VA capacity for loads above controller requirements. Provide secondary circuit breakers for controls and other devices indicated on plans. Do not feed motor heater circuits from starter CPT power source.**
28. Separate control terminals shall be provided for 24V DC power, logic level signals for permissive, start, jog forward, ramp start overload override and electric reset.
29. Control terminals shall be pull-apart for easy access and wiring.
30. Optional external interface circuitry shall include 120-volt relay logic interface capability.
31. A removable Customer Interface Module (CIM) shall be provided that allows for full adjustment of control and protection functions thru the use of potentiometers and DIP switches.
32. Power terminations shall consist of pressure type terminals.

33. Enclosure
 - a. Where separate enclosures are shown on plans, enclosures shall not be less than 16-gauge steel. Type 12 enclosures shall be of welded construction with gasketed heat sink and doors. See plans for alternate enclosure requirements.
 - b. The following shall be included:
 - 1) The operating handle of the disconnect, when supplied, shall always remain connected to the breaker or switch. The operating handle shall not be mounted on the door of the enclosure, but on the controller for safe “stand-aside” operation. The position of the operating handle will indicate ON or OFF position of switch or circuit breaker and include provision for padlocking in the OFF position. Through door mechanisms that have alignment rods are not permitted.
 - 2) Interlock provisions shall prevent unauthorized opening or closing of the starter door with the disconnect in the ON position.
 - 3) The structure, when floor-mounted, shall be provided with adequate lifting means and shall be capable of being rolled or lifted into installation position and bolted to the floor.
34. Controller characteristics shall be coordinated with motor manufacturer’s requirements and/or restrictions for soft-start controller starting and operation.
35. All enclosures for motor starters 100 horsepower and greater shall have forced air cooling. All enclosures for any size controller shall have forced fan air filters within enclosure.
36. Controller shall have ethernet, RS232, RS485 and Ethernet com ports for communicating, monitoring, and control interface with pump controller PLC. Provide all software, HMI templates, addresses, and programming in coordination with SCADA Programmer for a complete working control interface. Provide all required factory interface cables. Allow for Ethernet and/or ModBus or ModBus Plus communications protocol with Ethernet via fiber optic link to Master Control Station or to solid-state controller OIU. Provide all software and addresses.
37. Where Ethernet Fiber Optic (F.O.) communications link is indicated on plans, provide F.O. converter as required to interface controller or SCADA.

38. Manufacturer to provide all controller addresses, HMI and OIU templates and other data pertinent to SCADA programming by Engineer. No exceptions.
39. Where power factor correction capacitors are used or shown on plans, a capacitor contactor with a time delay relay, HOA switch and run light shall be used to connect capacitor to main bus. DO NOT connect capacitor across motor or on load side of starter. Contactor shall shunt starter on MCC set time delay such that any bypass contactors have transferred to Run before closing capacitor Contractor. Provide documentation of settings for Engineer review.
40. Vendors for equipment with solid-state controller shall include provisions for both hardwired and data path status, command and alarm functions included under contract without additional cost to Owner, Programmer, or Engineer.
41. Contactor shall include minimum of four single pole, double throw spare auxiliary contacts rated at 10 amperes continuous, for each starter furnished.
42. All equipment, instruments and devices provided for this project shall have means of protection from power line conditions such as surge, phase fail, or other line conditions that may damage equipment, instruments or devices furnished.

It is vendors and manufacturers' responsibility to provide protective devices as required for maintaining warranty of furnished items and to assure no damage occurs from power line conditions.
43. Factory Technician shall confirm which manufacturing modes that starter has been adjusted and programmed to operate in before operating motor. Program start and stop ramp time as agreed by Engineer. All well motors are to have extended ramp down when stopping. Coordinate ramp time with Engineer.
44. Controller shall have filters as required to prevent introduction of harmonics on motor power circuit when solid state SCRs are operating motor. Provide factory test dates that describes frequency and amplitude of any harmonics for Engineers review.
45. Provide auxiliary contacts on all motor circuit protectors (MCP), motor starter circuit breakers, motor starter overloads, solid state starters, variable speed drive units, MCC feeder breakers, main service breaker, generator main breaker, low voltage transformer primary breakers and other breakers shown with trip units on one-line diagram to show tripped condition. Route trip circuits to solid state controller, SCADA, pump controller, and autodialer inputs for alarm initiation and annunciation. Coordinate with all equipment, MCC, control panel and SCADA suppliers and, with programmers.

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.
 - 1. All printed circuit boards shall be functionally tested via fault finder bench equipment prior to unit installation.
 - 2. All final assemblies shall be load tested.

3.02 INSTALLATION

- A. Coordinate installation with other trades and install controller according to manufacturer's recommendations.
- B. Where Contractor fails to protect electronic soft start controller before and after installation on site and where excessive dust is observed inside the enclosure, the Contractor shall have a factory warranty service technician clean, inspect and test unit, after which the factory shall issue a written and signed statement that full factory is in effect. There are no exceptions to this requirement except to replace entire unit at Engineer's request.

3.03 FIELD QUALITY CONTROL

- A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section. The Manufacturer's Representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained herein. A Factory Technician shall provide all programming and set up adjustments for starter and shall provide a written report for Engineer's review. Report shall include value setting of each and every setting or adjustment for both hardware or software programmers. Engineer must approve operations of motor based on settings or certified by Factory Technician as correct for this project applications.
- B. The following minimum work shall be performed by the Contractor and Manufacturer's Representative under the technical direction of the manufacturer's service representative. Allow for a minimum of twelve (12) days for factory technician including all expenses for the following services:

1. Inspection and final adjustments for startup, and acceptance testing.
 2. Operational and functional test of controllers.
 3. Participation in commissioning services. Technical Representative shall be present for duration of commissioning tests related to vendor equipment.
- C. The Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made. Report shall include all hardware and software adjusted values and dates adjusted.
- D. Vendors for equipment with solid-state controller shall include provisions for both hardwired and data path status, command and alarm functions included under contract without additional cost to Owner, Programmer, or Engineer.
- 3.04 FIELD ADJUSTMENTS
- A. Make all adjustments according to manufacturer's recommendations. All adjustments and set-up shall be factory trained Technician only. No exceptions.
 - B. Coordinate adjustments of soft-start controller with other equipment adjustments, such as standby power generator.
- 3.05 FIELD TESTING
- A. Factory Technician shall test controller operation in presence of Engineer and/or Owners representative. Testing shall include oscilloscope recording of each phase let to observe any unwanted harmonic wave forms introduced on motor circuit during ramp up or ramp down of motor by the solid state SCR devices.
 - B. Provide field support for testing as required and at times needed with Programmer and Owner's Representative.
 - C. Factory Technician shall be present for final acceptance testing and shall demonstrate system operation to Engineer and Owner's Representative.
- 3.06 MANUFACTURER'S CERTIFICATION
- A. A qualified Factory-Technician shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.

- B. The Contractor shall provide three (3) copies of the certification and warranty before final payment is made.

3.07 TRAINING

- A. The Contractor shall provide a training session for Owner's Representatives at a jobsite location determined by the Owner.
- B. The training shall be conducted by a Manufacturer's qualified representative.
- C. The training program shall consist of the following:
 - 1. Instructions on the proper maintenance and operation of the equipment
- D. Training, travel and all other expenses shall be at no additional cost to Owner.
- E. See Section 16012 – “Electrical Work” for additional requirements.

3.08 WARRANTY

- A. All equipment and materials provided under the scope of this specification shall include full warranty for a period of 3 years from date of acceptance as described in Specification Section 16012. Full warranty includes all parts, materials, labor and shipping and delivery to jobsite.
- B. Contractor shall provide full 3-year service warranty on the overall installation, and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin at date of written final acceptance of electrical systems and shall include both labor and materials at no additional cost to owner. There are no exceptions to this requirement. Contractors warranty shall guarantee 24-hour service response time and shall provide whatever labor, work, or materials needed to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for over 24 hours from time Owner calls for warranty service. This shall be at no additional cost to Owner. All materials and equipment installed shall have full warranty from manufacturer that guarantees equipment is rated for the harsh Industrial Electrical/Mechanical environment in which it is installed. Where manufacturer's products fail prematurely, manufacturer shall be fully responsible for new replacement and shall not have option of declaring that failures were caused by environment and its affect on the product.

Contractor is fully responsible for assuring that product manufacturers are aware of this condition and that manufacturer's warranty statement is included in shop drawings. Failure to do so will be at full expense of Contractor and at no additional cost to Owner. Where warranty requirements are shown in other sections, the more stringent requirement shall have precedence.

END OF SECTION

SECTION 16496
AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor or Supplier and at no additional cost to Owner.
- C. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work,” for submittal requirements.
- D. Under no conditions shall transfer switch ampacity be rated less than main service breaker ampacity.
- E. Transfer switches with cable linkage when in manual mode are not accepted.**
- F. Coordinate power and controls with Generator Manufacturer where generator is shown on Plans.
- G. All outdoor unit enclosures to strictly conform to Item 2.02, Paragraph A, Number 3, Sentence 4 of this specification. Any unit installed that does not conform to this requirement shall not be submitted. Any unit installed that does not conform shall be removed in its entirety and replaced with correct unit.
- H. All equipment, instruments and devices provided for this project shall have means of protection from power line conditions such as surge, phase fail, or other line conditions that may damage equipment, instruments or devices furnished. It is vendors and manufacturers’ responsibility to provide protective devices as required for maintaining warranty of furnished items and to assure no damage occurs from power line conditions.

1.01 SUMMARY

A. Section Includes:

1. Delayed open transition automatic transfer switches to automatically transfer between normal and standby power sources.
2. Delayed open transition automatic transfer switches to transfer between normal and standby power sources by manually depressing a switch or push button for each transition required and to allow selection of automatic transfer from standby to normal power sources after being manually transferred from normal to standby power source. There shall be a pause in neutral position of switch for transfers in both directions with an adjustable time delay.
3. Service rated transfer switches.

1.02 REFERENCES

- A. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC)
- B. National Electrical Manufacturers Association (NEMA): NEMA ICS 2-447- AC Automatic Transfer Switches
- C. Underwriters Laboratories (UL): UL 1008 - Standard for Automatic Transfer Switches

1.03 SUBMITTALS

- A. Submit all products covered under this specification for Engineer's approval. **Constructor shall submit transfer switch data to Power Company for approval prior to submitting to Engineer.**
- B. Manufacturer shall submit shop drawings for review, which shall include the following, as a minimum:
 1. Descriptive literature
 2. Plan, elevation, side, and front view arrangement drawings, including overall dimension, weights and clearances, as well as mounting or anchoring requirements and conduit entrance locations.
 3. Schematic diagrams
 4. Wiring diagrams

5. Accessory list

- C. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Onan
- B. ASCO
- C. Russelectric
- D. Thomson Technology
- E. Lexington
- F. Zenith
- G. Or equal, as pre-approved in writing.
- H. Switchgear and MCC Manufacturers who furnish circuit breaker type service rated transfer switch assemblies as part of switch of MCC equipment.
- I. No substitutions allowed except where pre-approved in writing by Engineer.
- J. Listing of acceptable Manufacturers does not relieve obligation of conditions described in this Specification Section.

2.02 CONSTRUCTION

- A. General:
 - 1. The delayed transition automatic transfer switch shall be furnished as shown on the drawings. Voltage and continuous current ratings and number of poles shall be as shown. Switches shall be UL listed in accordance with UL-1008.

- a. Where transfer switch is shown on one-line diagram or on details as installed directly after service head and, where no overcurrent protection precedes the transfer switch, a service rated, breaker type switch shall be provided.
 - b. **Ampacity of transfer switch contacts shall be rated equal or greater than ampacity of main service breaker and/or MCC bus. No exceptions.**
2. On 3 phase, 4 wire systems, utilizing ground fault protection down stream of the transfer switch, a true 4-pole switch shall be supplied with all four poles mounted on a common shaft. The continuous current rating and the closing and withstand rating of the fourth pole shall be identical to the rating of the main poles and shall have quick-break contacts. See plans for 4 pole requirements. This requirement does not apply for water and wastewater facility installation.
 3. The transfer switch shall be mounted in a NEMA 1 enclosure for indoors, and NEMA 4X 316 S.S. for outdoors, unless otherwise indicated. Indoor enclosures shall be fabricated from 12-gauge steel. The enclosure shall be sized to exceed minimum wire bending space required by UL 1008. Outdoor enclosures shall have no exposed controls. Fabricated covers over exposed controls are not allowed. Controls shall be located on inner door of automatic transfer switch. Enclosure shall have three (3) point latching handle with locking hasp. Where shown on plans in MCC, transfer switch enclosure shall match MCC enclosure.
 4. The transfer switch shall be equipped with an internal welded steel pocket, housing an operations and maintenance manual.
 5. The transfer switch shall be top and bottom accessible.
 6. The main contacts shall be capable of being replaced without removing the main power cables, or removing incoming normal power from service rated transfer switches.
 7. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.
 8. All bolted bus connections shall have Belleville compression type washers.
 9. When a solid neutral is required, a fully rated bus bar with required AL-CU neutral lugs shall be provided.

10. Control components and wiring shall be front accessible. All control wires shall be multi-conductor 18-gauge 600-volt SIS switchboard type point-to-point harness. All control wire terminations shall be identified with tubular sleeve-type markers.
11. The switch shall be equipped with 90 degrees C rated copper/aluminum solderless mechanical type lugs.
12. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.
13. Transfer time shall be of sufficient duration to allow motor run controls to drop out or, Contractor shall provide additional time delay controls in the neutral position, both directions of transfer to accomplish this function.
14. Provide 480: 120/240 volt, single phase transformer and all required circuit breakers to provide low voltage power to all generator heaters, controls, etc. Feed from load motor control center or, from side of ATS where shown on plans.
15. All power and control circuits to have circuit breakers for overcurrent protection. Fuses are not acceptable. No Exceptions.
16. All doors on outdoor enclosures shall have door restraints, 3 point latching handle and locking hasp. Keyed handles are not acceptable.
17. No devices or controls are to be installed on outer door of outdoor enclosures or where NEMA 4X rated.
18. Provide generator status annunciator with voltage, current, and phase indicators and run time (non-resettable) elapse time meter in panel (door) of indoor transfer switch. Provide nameplate. Flush mount annunciator. Where ATS is located outdoors or in NEMA 4 X enclosure, mount status annunciator in inner door panel. Installation to be completed by ATS Factory Technician.
19. Install Generator Manufacturer furnished alarm annunciator panel on wall near ATS or as shown on plans.
20. All circuit breakers shall be covered. No exposed circuit breakers. No exceptions.
21. Provide heater with thermostat control in all enclosures. Route 120 VAC circuit from LVP. Provide circuit breaker.

22. Provide all power supplies required to operate transfer switch.
23. Where transfer switch contains two circuit breakers, and where service breaker serves as main breaker, the transfer switch shall be UL listed, "Service Rated," and acceptable to Power Company.

B. Automatic Transfer Switch:

1. The transfer switch shall be double throw, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Cable linkage mechanism is not acceptable.
2. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungston alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable unless specifically shown on Plans, or pre-approved in writing.
3. The transfer switch shall be equipped with a safe external manual operator, designed to prevent injury to operating personnel. The manual operator shall be front accessible and shall provide "quick make-quick break" operation, offering the same contact-to-contact transfer speed as the electrical operator to prevent switching the main contacts slowly. The external manual operator shall be UL listed for operation, under load, from the outside of the transfer switch while the door is closed. Door shall have 3 point latching handle. No automatic transfer switch enclosure shall be installed without door; Exerciser timer shall be readily accessible to operator.
4. Circuit breakers used for service rated transfer switches shall be mechanically or electrically interlocked in a manner acceptable to the local Power Company.
5. Provide all AC and/or DC power supplies required for transfer switch operation. Provide separate batteries and charger where operation requires separate power source independent of normal or generator power sources.

C. Automatic Transfer Switch Controls:

1. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with Nicad battery back up.

2. The CPU shall be equipped with self-diagnostics, which perform periodic checks of the memory I/O, and communication circuits, with a watchdog/power fail circuit.
3. The controller shall use industry standard open architecture communication protocol for high speed serial communications via multi-drop connection to other controllers and to a master terminal with up to 4000 ft of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible. In addition, provide Ethernet port for communicating with plant PLC controller via a data switch.
4. The Ethernet communication port shall allow interface to the Manufacturers and/or the Owner's furnished remote supervisory control. Provide all software, programming, testing, and cables and hardware for a complete operating system. Coordinate with SCADA Provider and Programmer and assist in setting up system. Provide all addresses, HMI templates, and function descriptions for Programmer's use. Functions shall include status of all operating time settings such as transfer time, transition delays, etc.
5. The controller shall have password protection required to limit access to qualified and authorized personnel.
6. The controller shall include a 20 character, LCD display, with a keypad, which allows access to the system.
7. The controller shall include three phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.
8. The controller shall be capable of storing the following records in memory for access either locally or remotely:
 - a. Number of hours transfer switch is in the emergency position.
 - b. Number of hours emergency power is available.
 - c. Total transfer in either direction.
 - d. Date, time, and description of the last four source failures.
 - e. Date of the last exercise period.
 - f. Date of record reset (where applicable).

D. Sequence of Operation:

1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-300 seconds factory set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.
2. The transfer switch shall transfer to emergency when the generating plant has reached specified voltage and frequency on all phases.
3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-3600 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.
4. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-3600 seconds, factory set at 300 seconds.

E. Automatic Transfer Switch Accessories:

1. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.
2. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-300 seconds. Factory set at 3 seconds, if not otherwise specified.
3. Time delay to control contact transition time on transfer to either source. Programmable 0-120 seconds, factory set at 10 seconds.
4. Time delay on retransfer to normal, programmable 0-3600 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-3600 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal. Time delay in neutral position of switch shall be adjustable 0-300 seconds.

5. Time delay on transfer to emergency, programmable 0-300 seconds, factory set at 1 second.
6. A maintained type load test switch shall be included to simulate a normal power failure, keypad initiated.
7. A remote type load test switch shall be included to simulate a normal power failure, remote switch initiated.
8. A time delay bypass on retransfer to normal shall be included. Keypad initiated.
9. Contact, rated 10 Amps 30 volts DC, to close on failure of normal source to initiate engine starting.
10. Contact, rated 10 Amps 30 volts DC, to open on failure of normal source for customer functions.
11. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position, and controller is running.
12. A plant exerciser shall be provided with ten (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one-minute increments. Also include selection of either "no load" (switch will not transfer) or "load" (switch will transfer) exercise period. Keypad initiated with password. Provide means to observe and adjust settings locally and via data link to plant PLC controller.
13. Provision to select either "no commit" or "commit" to transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load will transfer to the emergency position unless normal power returns before the emergency source has reach 90% of its rated values (switch will remain in normal). In the "commit position", the load will transfer to the emergency position after any normal power failure. Keypad initiated.
14. Two auxiliary contacts rated 10 Amp, 120 volts AC (for switches 100 to 800 amps) 15 amp, 120 volts AC (for switches 1000 to 4000 amps), shall be mounted on the main shaft, one closed on normal, the other closed on emergency. Both contacts will be wired to a terminal strip for ease of customer connections.

15. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase-to-phase voltages simultaneously, for both the normal and emergency source.
16. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.
17. An LCD readout shall display normal source and emergency source availability.
18. Signal before transfer contacts.
19. Selector switch to allow transfer by manual push button or switch movement.
20. Maintenance Selector Switch: For service rated transfer switches provide means to deactivate switch in “Normal,” “Open,” or “Emergency” positions when servicing internal parts of switch assembly. Provide means for locking out in any position.
21. Provide means to temporarily switch off “All” control voltages that are tapped on the incoming power side of the Normal circuit break for maintenance purposes. This is to remove all live voltages during service of transfer switches.
22. Provide all available “Options” for transfer switch.

F. Ratings:

1. Delayed transition automatic transfer switches shall have the following 3-cycle short circuit closing and withstand as follows:
 - a. RMS Symmetrical Amperes 480 VAC

<u>Amperes</u>	<u>Closing and Withstand</u>	<u>Current Limiting Fuse Rating</u>
100-400	42,000	200,000
600	50,000	200,000
800	65,000	200,000
1000-1200	85,000	200,000
1600-4000	100,000	200,000

2. During the 3 cycle closing and withstand tests, there shall be no contact welding or damage. The 3 cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contacts separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories, Inc.
 3. When conducting temperature rise tests to UL-1008, the manufacture shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.
 4. The microprocessor controller shall meet the following requirements:
 - a. Storage conditions - 25 degrees C to 85 degrees C
 - b. Operation conditions - 20 degrees C to 70 degrees C ambient
 - c. Humidity 0 to 99% relative humidity, non-condensing
 - d. Capable of withstanding infinite power interruptions
 - e. Surge withstand per ANSI/IEEE C-37.90A-1978
 5. Manufacturer shall provide copies of test reports upon request.
- G. Provide means to remotely monitor switch positions via a data network. See electrical plans for additional requirements. Provide all programming, software and devices. Provide on CD all addressing information for starter, alarm, and functions available for display at PLC HMI. Manufacture's Representative shall provide setup assistance during construction. Coordinate with Generator and Data Monitoring Systems Vendors to assure a unified power system.
- H. Manufacturer:
1. The transfer switch manufacturer shall employ a nationwide factory-direct, field service organization, available on a 24-hour a day, 365 days a year, call basis.
 2. The Manufacturer shall include an 800-telephone number, for field service contact, affixed to each enclosure.
 3. The manufacturer shall maintain records of each transfer switch, by serial number, for a minimum 20 years.

- I. Warranty: Provide Manufacturer's standard full 5-year comprehensive extended coverage service. Warranty shall be "on site" and warranty service shall be available by the factory service department on an emergency basis if required. Depot or non-site warranties are not acceptable.
- J. Load Bank Controls:
 - 1. Where load bank is required, provide all controls, contactors, and devices needed to exercise generator on load bank. Normal plant loads shall not be on generator during load bank operation of generator.
 - 2. Coordinate with Generator Vendor.
 - 3. Submit load bank controls data.
- K. Provide fiber optic connector interface where indicated on plans.
- L. Where transfer switches are used ahead of main breaker or include main breaker, unit shall be "service rated" and shall have normal service breaker rated for service ampacity.

2.03 PROTECTION

- A. All equipment installed on this project shall incorporate all devices and features to protect that equipment from the influence of other equipment, line voltage and phase irregularities, harmonics and other disturbances that may effect the proper and safe operation of that equipment whether these required features are a standard component of that equipment as an off-the-line product. No equipment shall be installed without these features.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Automatic Transfer Switches shall be provided with adequate lifting means for ease of installation of wall or floor mounted enclosures.
- B. Provide access and working space as indicated or as required.

- C. Where Contractor fails to protect automatic transfer switches before and after installation on site and where excessive dust is observed inside the enclosure, the Contractor shall have a factory warranty service technician clean, inspect and test unit, after which the factory shall issue a written and signed statement that full factory is in effect. There are no exceptions to this requirement except to replace entire unit at Engineer's request.

3.02 ADJUSTMENTS

- A. Tighten assembled bolted connections with appropriate tools to manufacturer's torque recommendations prior to first energization.

3.03 START-UP AND TESTING

- A. Provide the services of a Factory Technician to checkout, adjust, set-up, test, and start-up the automatic transfer switch in conjunction with the standby generator. Fully function test the automatic transfer switch to verify proper operation.
- B. A Factory Technician shall be present for final acceptance testing and shall demonstrate unit operation to Engineer and Owner's Representative.
- C. Factory Representative shall demonstrate operation of system to Owner and Engineer.

3.04 TRAINING

- A. Provide two (2) 4-hour training courses conducted by Manufacturer's Representative at a time approved by Owner and Engineer. Provide training outline to Engineer for approval of contents. Notify Engineer of training schedule. Engineer may be present. Training shall include operation and required owner service and preventative maintenance. Operation and Maintenance Manuals shall be used during training for reference.

3.05 WARRANTY

- A. Contractor shall provide the Manufacturer's full 5 year comprehensive extended coverage service warranty on the generator installation and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written "Final Acceptance" of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor's warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order.

In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed. Where Manufacturer's products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its affect on the product.

Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor's expense and at no additional cost to the Owner.

- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.
- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

END OF SECTION

SECTION 16662
MOTOR MANAGEMENT RELAY

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Contractor shall comply with Paragraph 3.07, A, 3 of this specification, for programming allowance requirements before bidding.**
- C. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- D. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractors expense. See Section 16012 – “Electrical Work,” Paragraph 1.04 – “Submittals” for submittal requirements.

1.01 SUMMARY

- A. Section Includes:
 - 1. Motor Management Relay (MMR) and related devices commonly used with them.
 - 2. Programming Requirements.

1.02 REFERENCES

- A. National Fire Protection Association (NFPA): NFPA 70-90 - National Electrical Code (NEC).

1.03 DEFINITIONS

- A. Motor Management Relay (MMR): Primary protective function shall be the thermal model consisting of four key elements:
 - 1. IEC 60255 – 8 Thermal Overload curves
 - 2. Negative sequence unbalance/single phase bias

3. (13) RTD Biasing (hot/cold motor compensation)
4. Motor cooling time constants
5. Stall protection
6. Motor Status
7. Current unbalance

1.04 SUBMITTALS

A. Shop Drawings:

1. Motor Management Relay showing dimensions and features including installation details.
2. Current and potential transformers showing dimensions, wiring instructions, wiring diagrams and features including installation details.

B. Product Data:

1. Product data for motor management relay, C.T.'s, P.T.'s and accessories specified in this Section, including descriptive data and C.T. ratios.
2. Include parts list.

C. Test Results: Certified reports of field tests and observations.

D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

E. Operation and Maintenance (O&M) Manuals: Provide O&M on CD. See Section 16012 – "Electrical Work" for additional requirements. Contract Engineer for format and contents.

1.05 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. Components and Installation:
 - a. NFPA 70 "National Electrical Code (NEC)."
 - b. Local codes and ordinances.

C. Single-Source Responsibility: Obtain C.T.'s and P.T.'s from single manufacturer of MMR.

D. See requirements of this specification section for **password** requirements.

1.06 MAINTENANCE

A. Extra Materials:

1. Maintenance Stock, Spare Parts: As recommended by Manufacturer.

PART 2 PRODUCTS

2.01 MOTOR MANAGEMENT RELAY (MMR)

- A. General: Provide MMR in indicated type, as integral components of panelboards, switchboards, and motor control centers; and also as individually enclosed and mounted single units. Provide externally mounted 48 hour UPS for MMR 120 volt source. Submit UPS VA size.
- B. Enclosures: Manufacturers draw-out construction to facilitate testing and maintenance. Unit to be recessed in MCC starter section flush with door and shall not protrude out more than 2 inches from door surface. Coordinate with MCC Manufacturer for adequate space behind door.
- C. Features: The motor management relay shall include complete power metering. An events recorder shall store the last 1024 events at minimum. Sixteen cycles of waveform data shall be stored each time a trip occurs. The user interfaces shall include:
 1. A large color LCD front panel display and associated navigation keys to provide access to actual values and set points.

2. A front panel USB port for connectivity to configure settings and retrieve operation records.
 3. An Ethernet port that shall use the MODBUS RTU & MODBUS TCP/IP protocols.
 4. The relay shall provide an option for role based access control.
 5. Ethernet port shall be provided on back of unit. Route cable to ethernet switch.
 6. Manufacturer set password shall be sent to programmer.
- D. The stator protective thermal model shall combine inputs from positive and negative sequence currents and RTD winding feedback. The protection shall also include:
1. Stall
 2. Jam
 3. 13 RTD inputs
 4. Ground Overcurrent
 5. Short Circuit
 6. Differential protection using CT inputs; (6) from both sides of the machine winding.
 7. Voltage transformer inputs, which shall be used to provide over-voltage, under-voltage, voltage phase reversal, over-frequency and under-frequency functions.
- E. MMR shall store up to 1024 time and date stamped events, including the pre-tip data. For each trip, the MMR shall store a trace of 8 cycles pre-trip and 8 cycles post-trip for all measured AC quantities.
- F. Manufacturer: G.E. Multilin
- G. Base Model: 869
- H. **Model Order Code: 869-E-P5-NN-G5-H-N-N-A-N-N-G-S-P-B-C-SE-N-N-B-N**

2.02 CURRENT TRANSFORMER (CT)

- A. Phase current CT's shall be provided for all three phase legs. In addition, a ground CT shall be provided. CT size and rating to be determined by MMR manufacturer and shall be furnished as part of the MMR equipment package. Include mounting brackets and all appurtenances. **CT's shall be sized to detect peak inrush current of motor.** Provide load resistor across terminals.

2.03 POTENTIAL TRANSFORMER (PT)

- A. A 3 phase PT shall be provided for voltage measurements of all three phase legs. PT size and rating shall be determined by MMR manufacturer and shall be provided as part of the MMR equipment package. Include mounting bracket and all appurtenances. PT shall be rated for 5 kV minimum.

2.04 SOFTWARE

- A. Complete instructions and any special equipment required for installation, setup, programming, operation, maintenance and data analysis shall be provided as part of the MMR equipment package. Special cables, plugs and adaptors for loading and downloading data to a computer shall be included. Equipment and documentation shall be sent to programmer.
- B. All programming shall be done by "Systems Integration Engineer" per requirements of this specification section. **Passwords shall be the Shrader Engineering four (4) digit project number and shall be set up by the Programmer only. Contractor shall not set up passwords.**
- C. All programming will be coordinated with Motor Manufacturers and shall conform to their standards.
- D. Manufacturer to provide all controller addresses, HMI and OIU templates and other data pertinent to SCADA programming by Engineer. No exceptions.
- E. **Passwords shall be used until the end of the construction warranty period, at which time Owner may elect to change.**

2.05 UNINTERRUPTIBLE POWER SUPPLY

- A. Contractor shall provide an across the line type UPS with sufficient battery capacity to maintain all memory data for a period of 48 hours during power interruption.

- B. UPS shall be equal in quality and capacity to APC SMART-UPS. Install UPS within an MCC enclosure section with other UPS unit. Submit UPS VA size & manufacturer recommendation documentation.

2.06 RTD'S

- A. Provided by Motor Manufacturer or as specified by Motor Manufacturer for specific motor furnished. These requirements are to be coordinated with Motor Supplier prior to bidding. Failure to do so is at Contractor's expense and at no additional cost to Owner. This also applies to where motor is delivered without RTD's.
- B. Provide 100 ohm platinum RTD's.

PART 3 EXECUTION

3.01 INSTALLATION

A. MMR

1. Install MMR as shown on plans or as described in specifications.
2. Installation shall be done according to manufacturers recommendations and shall be done in a neat and professional manner. See Paragraph 2.1 – “Motor Management Relay (MMR),” Item B for additional information.
3. Locate as indicated and install in accordance with manufacturer's written installation instructions.
4. Provide devices and connections to MMR as shown on plans.

B. Current and Potential Transformers:

1. CT's and PT's shall be rated for electrical system voltage and current parameters and shall be installed according to the manufacturer's recommendations with hardware intended for mounting P.T.'s and C.T.'s.
2. Warning: When energized, open CT circuit can have lethal voltages. Use caution when servicing live CT circuits.

- C. Bypass Switch: Where Multilin is installed in motor control circuit, provide a key operated selector switch and bracket located on backplate behind door to allow bypass of alarm contacts so as to allow well pump to be operated under emergency conditions when Multilin unit has failed or is removed for service.

Provide nameplate to indicate key position. Provide additional controls for use with SCADA system. Provide four (4) sets of keys. See plans for additional information.

3.02 IDENTIFICATION

- A. Identify components and wiring in accordance with Section 16195 – “Electrical Identification.”

3.03 CONTROL WIRING INSTALLATION

- A. Wiring to C.T.’s and P.T.’s shall be installed according to related NEMA and NEC standards and codes. All wiring to be rated for application and shall be neatly bundled and secured with clamps. No stick on clamps are to be used. All wires are to be terminated with proper lugs. C.T. lugs shall be ring type only.

3.04 CONNECTIONS

- A. Check connectors, terminals, bus joints, and mountings for tightness.
- B. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.05 GROUNDING

- A. Provide equipment grounding connections for individually mounted Overcurrent Protective Devices (OCPD) units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.06 COORDINATION STUDY

- A. Where coordination study recommends changes in types, classes, features or ratings of equipment or devices indicated, make written request for instructions. Obtain instructions from Engineer before ordering equipment or devices recommended to be changed.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's technician for equipment specified herein shall be present at job site or classroom designated by Owner for minimum of 1 workday, travel time excluded, for assistance during plant construction, plant startup, equipment adjustment, and training of Owner's personnel for equipment service and maintenance. Include minimum of:
 - a. One-half (1/2) person-day for technical services, set-up and testing in presence of Engineer.
2. Supplier or manufacturer shall direct services to specific system and equipment operation, maintenance, and troubleshooting.
3. Programming of the motor management relay alarm and trip set points and all testing shall be performed by the "Systems Integration Engineer." No Exceptions. Contractor shall include an "Allowance" for motor management relay set point programming.

Where programming "Allowance" is not shown on bid sheet, contact Shrader Engineering, (713) 467-9961 for details before bidding. Provide fax number for receipt of "Allowance" confirmation. Failure to provide an "Allowance" will be at Contractors risk and cost. Contractor shall coordinate installation, programming, and setup testing with motor manufacturer and "Systems Integration Engineer."
4. All of the motor data available from the manufacturer, including overload curves and thermal characteristics, and all motor circuit information must be furnished by the Contractor to the Engineer a minimum of two weeks prior to programming of Multilin unit or six (6) weeks prior to date MCC or starter is to be energized, whichever is more stringent requirement.
5. Operational training for Multilin shall be provided by the "Systems Integration Engineer" defined in Paragraph 3 above.
6. Manufacturer or Representative shall provide operating instructions CD. Contact Engineer for format and contents.

B. Testing:

1. Reports: Prepare certified written reports on tests and observations. Report all defective materials, workmanship, and unsatisfactory test results. Include complete records of repairs and adjustments made.
2. Labeling: Upon satisfactory completion of tests and related effort, apply label to tested components indicating test results, date, and responsible person.
3. Schedule visual and mechanical inspections and electrical tests with at least 1 week's advance notification.
4. Pre-testing: Upon completing installation of system, perform following preparations for tests:
 - a. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
 - b. Make continuity tests of circuits.
 - c. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
 - d. Comply with manufacturer's instructions for installation and testing of OCPDs.
5. Visual and mechanical inspection: Include following inspections and related work.
 - a. Overcurrent Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make final system adjustments.
6. Retest: Correct deficiencies identified by tests and observations and retest. Verify by system tests that specified requirements are met.

3.08 CLEANING

- A. Upon completion of installation, inspect MMR. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.09 REPLACEMENT

- A. Where failure or damage occurs prior to final acceptance by Owner, a new unit shall be installed at no additional cost. Repaired units are not acceptable. No Exceptions.

3.10 SERVICE

- A. Provide 24-hour service response during warranty period. Replacement unit for critical applications such as water well motors shall be provided within 48 hours.

3.11 WARRANTY

- A. Contractor shall provide full 10-year service warranty on the overall installation, and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written “Final Acceptance” of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor’s warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order.

In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner.

All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed. Where Manufacturer’s products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures where caused by environmental conditions and its affect on the product. Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor’s expense and at no additional cost to the Owner.

- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.

- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

END OF SECTION

SECTION 16904

CONTROLLER

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. **Contractor shall comply with programming allowance requirements of Item 1.01 – “Work Included” of this specification section. Read before bidding.**

Contractor or his Subcontractors are not responsible for contents of program installation and/or operation of program. Warranty for operation program is solely the responsibility of the Programmer, Shrader Engineering. There are to be no contractual agreements between the Contractor and/or his Subcontractors and the Programmer, Shrader Engineering. See Section 1.01 of this specification for full requirements.

- C. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- D. **Only Manufacturers listed in Item 1.04 – “Controller Assembly” may assemble controller panels for this project. Control Panel Manufacturers may not bid as “General Contractor” for SCADA System installations, unless approved by Facility Owner.**
- E. The Owner and the Engineer will review system technical information as submitted by the Contractor for hardware, peripheral devices, software operating system, database, control logic, and alarming for complete compliance with these specifications.
- F. Follow requirements of Section 16016 – “Control Panels” for controller panel assembly.
- G. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work,” Item 1.04 – “Submittals” for submittal requirements.

1.01 WORK INCLUDED

- A. This section covers work necessary for the installation, field testing and startup and final documentation for a plant controller unit system hereafter referred to as the controller and as described herein.
- B. Programmable Logic Controller (PLC), Personal Computer (PC), laptop computer, Operator Interface Unit (OIU), and Human Machine Interface (HMI) hardware and software are to be provided by Contractor. All drivers and related software purchased by Contractor shall be compatible versions to allow satisfactory interface of systems.
- C. All software shall be provided by Contractor and shall include license, keys, access codes, and required drivers. All programming for the controller will be performed by Shrader Engineering's Systems Integration Engineer. Contractor shall provide an "Allowance" in his bid price for programming work. Where "Allowance" amount is not shown on bid sheet, contact Shrader Engineering at (713) 467-9961, for "Allowance" cost. Provide email or fax number in order to receive "Allowance" confirmation from "Systems Integration Engineer." Failure to include this allowance is at the expense of the Contractor and at no additional cost to Owner. Software and equipment data shall be provided to Systems Integration Engineer at time of shop drawing submittal. Contractor shall allow for a minimum of 30 working days for loading and testing controller programs. Provide four (4) weeks advance notice to Programmer for downloading programs. See Section 16012 – "Electrical Work," Item 1.00 – "Conditions" and Item 3.08 – "Testing and Setup" for additional information and conditions.

A temporary program will be downloaded for testing and subsequently removed at completion of testing. The final program will be downloaded upon receipt of allowance payment. Programmer is not responsible for any delays due to non-compliance by Contractor.

- D. Where radio, fiber optic, telephone, data line, communication line or other means of communications between control or SCADA system components is provided, Contractor shall be responsible for coordination of hardware and software to assure compatibility for satisfactory communications and accurate transfer of data is accomplished. Communications link shall be fully tested and properly working before Engineer's testing, inspection or PLC programming will be conducted.

1.02 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall be responsible for and shall provide for the supply, delivery, installation, certification, calibration, adjustment, testing and startup, of a complete, coordinated system, which shall perform the specified functions indicated herein, and as indicated on the plans.
- B. System Fabricators shall provide full warranty on all systems furnished for this project. Proof of warranty liability shall be provided before submittals will be accepted. It is the Contractor's responsibility to obtain the above noted certifications before accepting Fabricators or Suppliers products for this project. All equipment shall be of professional quality as a finished product. All components shall be manufactured for the explicit purpose of use. This includes both interior components and exterior finish of enclosures.
- C. Electrical Contractor shall have Master Electrician License for City or county in which project is located, and shall have a State issued Master Electrician License.
- D. The Contractor shall provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the control system. The personnel shall be present on-site as required to affect a complete and operating system.
- E. Furnish resume of experience for supervisor directly in charge of project and who will be directly supervising day-to-day on-site activities of contractor's employees or sub-contractors.
- F. Local construction permits shall be sole responsibility of Contractor. Local inspection authorities' acceptance is required before final acceptance of system.
- G. Any equipment, devices, or software required for this project, and that may be overlooked by Owner or Engineer at final acceptance, shall still be provided by Contractor at no cost to Owner regardless of period of time that expires before Owner requests to be furnished and installed.
- H. All equipment, instruments and devices provided for this project shall have means of protection from power line conditions such as surge, phase fail, or other line conditions that may damage equipment, instruments or devices furnished. It is vendors and manufacturers' responsibility to provide protective devices as required for maintaining warranty of furnished items and to assure no damage occurs from power line conditions.

1.03 CONTRACTOR QUALIFICATIONS

- A. Contractor (or Sub-Contractor) may be required to submit a statement of qualifications to the Engineer before bid is awarded for control system work. Qualification Statement shall show proof of similar plant installations for not less than four (4) recent projects in County of project location or, immediate vicinity thereof. Provide name of project; name of Owner, address and telephone number of Owner's representative who can be contacted for references regarding successful completion and satisfactory performance of most recent projects.
- B. See Section 16012 – "Electrical Work" for additional Contractor qualifications.
- C. Electrical installers and programmers assigned to this project shall be full time qualified employees. Contract type employees are not allowed unless preapproved by Engineer. Contractor will be required to furnish proof of experience and employment where requested by Owner or Engineer or their Representatives.

1.04 CONTROLLER ASSEMBLY

- A. Controllor assembly may be performed by the following System Integrators:
 - 1. Weimar Manufacturing
 - 2. Texas Industrial Control Manufacturing (TICM)
 - 3. BL Technology
 - 4. W.W. Payton Corp.
 - 5. Ace Controls
 - 6. Systems, Inc.
 - 7. Or, as pre-approved by Engineer in writing ten (10) days before bid date.
- B. Exact component requirements shall be confirmed with Controllor Manufacturer's Local Representative.

1.05 SUBMITTALS

- A. Submit all products covered under this section for Engineer's approval. Provide entire submittal on CD. No exceptions.

- B. Hardware Submittals: Before any components are fabricated, and/or integrated into assemblies or shipped to the job site, furnish to the Engineer for his review six (6) copies of submittal documents. In addition, provide all submitted data on CD. Submittals shall include full details, shop drawings, catalog cuts and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these specifications. Specifically, the Contractor shall submit the following materials:
1. Block diagram and operational description of the system showing all major components and their interconnections and interrelationships. Label each diagram and specify all external power and communications interfaces. All diagrams shall be in an 11 by 17 format. Provide CD in AutoCad Release 14 format.
 2. Drawings of equipment to be supplied shall include, as a minimum: overall dimension details for each panel, console, etc., including internal and external arrangements and door mounted operator devices with nameplate designations. Wiring diagrams of equipment including field device connections shall be included and specific installation/wiring requirements identified. Provide in AutoCAD format on CD.
 3. Operational Description shall include the principal functions/capabilities of the controller, as provided and configured/programmed. Included shall be a description of system communications.
 4. Provide a detailed Bill of Materials along with descriptive literature identifying component name, manufacturer, model number, and quantity supplied.
 5. Provide system hydraulic layout(s) where applicable.
 6. Complete wiring diagrams showing interface to other equipment. Contractor shall coordinate interconnection of equipment furnished by others.
- C. Software Submittals
1. Provide user manuals for all PLC manufacturer furnished software and firmware. For ancillary software such as spreadsheets being supplied under this contract, only a listing of the manuals, which will be included with the O & M's, is required.
 2. Provide communication and control database programs for project in hardcopy form. As a minimum, hardcopy form shall be fully documented, including code, comments, addressing data and cross-references, etc. Every line or section of code shall be accompanied by a comment describing its function.

3. Provide all required licensed programming software with submittals. All software to be new and original from PLC manufacturer. Provide on CD in original package. Provide any required “keys” or means for accessing and using software.
4. Test Outlines and Procedures Submittals: Test descriptions shall be in sufficient detail to fully describe the specific tests to be conducted to demonstrate conformance with this specification.
5. Spares and Expendables Recommendations: The Contractor shall provide a list of recommended spares and expendable items. The list shall be exclusive of any spares furnished under this Contract. A total purchase cost for the recommended list shall be provided in addition to the unit cost for each item. See Item 2.06 – “Spare Parts” for additional requirements.
6. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.
7. All submittals for motor control centers, control panels, control sections, SCADA panels, lift pump panels, and Vendor furnished panels must contain statement of U.L. certification and identifying name and number of U.L. certification.

1.06 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The Contractor shall provide (6) complete sets of hard-covered ring-bound loose-leaf O&M manuals. In addition to “as-built” system drawings, the manuals shall include internal wiring diagrams and operating and maintenance literature for all components provided under this section. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument. The O&M manual shall be professionally composed and compiled and shall not be an assembly of “cut-sheets.” Engineer shall have sole discretion of acceptance of O&M manual contents and composition.
- B. The contents of the O&M manuals shall be generally organized as follows:
 1. System Hardware/Installation
 2. System Software
 3. Operation (step-by-step procedures)

4. Maintenance and Troubleshooting
 5. Schematic Diagrams and Wiring Diagrams
 6. As-Built Drawings
 7. Warranty Certificates
- C. Where a control system is to be installed under this contract or where existing and noted, the Contractor shall further provide a complete set of as-built plans, diagrams, parts and materials list, parts source, operational instructions, programming data, maintenance and trouble shooting instructions, service data, calibration data, testing data, required service and programming instruments and wiring diagrams sufficient for complete operation, service and programming and maintenance of the System by plant technicians and operators or by outside service technicians. This information shall be provided on CD in AutoCAD 14, or later version, and in Word format and shall be arranged in final order for insertion into System files. Coordinate overall layout and contents with Engineer and with System Programmer. Allow adequate person-hours for adjustment of layout and contents during System testing and Owner review. All data submitted will be reviewed by Engineer for acceptance and where deemed insufficient by Engineer, data will be resubmitted at no additional cost to Owner.

1.07 DEFINITION OF ACCEPTANCE

- A. System acceptance upon substantial completion shall be defined as that point in time when the following requirements have been fulfilled:
1. All O&M documentation has been submitted, reviewed, and approved.
 2. The complete control system and instrumentation have successfully passed all acceptance testing requirements specified herein and have successfully been started up, tested and accepted by the Engineer in writing. This includes the (90) day operating period described in Specification Section 16012 – “Electrical Work”, Item 3.08, Paragraph 2.
 3. All Owners’ staff personnel training programs have been completed.
 4. Owner/Engineer sign a document indicating system has formally been accepted. This will occur after all final inspection discrepancies have been corrected to Engineer’s satisfaction.
 5. Warranty certificates have been accepted.

6. All as-built drawings have been received and approved.
7. Spare parts have been delivered.
8. Where complete wiring diagrams have been delivered.

PART 2 PRODUCTS

2.00 GENERAL

- A. The functions and features specified hereunder are the minimum acceptable requirements for the system. The provided system shall equal or exceed each requirement.
- B. In some cases, the specifications may allow the accomplishing of certain functions by means of more than one hardware/firmware/software approach. Any approach that is proposed shall equal or exceed all functional, operational, convenience and maintenance aspects of the one described. Whether a proposed approach is equal to or exceeds specification requirements shall be in the sole discretion of the Engineer.
- C. Major equipment, component, and software items are specified; however, the Contractor shall, at no additional cost, provide all appurtenant items, whether specifically referenced herein or not, but which may be required for system operation as herein specified.
- D. All equipment, materials, and hardware shall be new and unused. Any failed equipment or device shall be replaced with new component. Repaired components are not acceptable.
- E. All solidstate controllers installed in MCC's shall have 2 hour UPS (under full load). All solidstate controllers installed in lift station control panels shall have 30 minute UPS.
- F. All signals up to point of PLC terminals shall be tested by Contractor and acknowledged in writing to Engineer prior to installation or testing programs.
- G. Major components of this system shall include the specified materials, equipment, and installation required to implement a complete and operational control system along with associated instrumentation.
- H. In order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service to the greatest extent possible, like items of equipment provided hereunder shall be the end products of one (1) manufacturer.

- I. Requirements for the electrical work associated with the installation of the controller and instrumentation equipment are as specified in other sections.
- J. Controller shall be Schneider Electric's Modicon M340 unless otherwise indicated on plans as higher level unit, or equal, pre-approved in writing.

PLC Name	Series	Model	Location
PLC-1	Modicon M340	BMXP342020	Autosensory Panel

- K. PLC system to include all required processors, I/O modules, communication modules, and all other modules necessary for a complete operating system, mounted in factory rack.
- L. All interconnect cables and connectors for PLC's, RTU's, and controllers shall be factory manufactured and/or assembled.
- M. All overcurrent protection devices for controls, PLC's, power supplies, etc. shall be circuit breakers, no fuses of any size are allowed.

2.01 FUNCTIONAL REQUIREMENTS

- A. General
 - 1. The controller system shall monitor and control the equipment functions stated herein, as described in other specifications, and as indicated on the plans. Functional requirements shall be coordinated with other equipment requirements and approved by the Engineer.
 - 2. Under this contract, the Control System Contractor is to interconnect all listed systems, setup controls for all systems and, in general, provide a complete unified operating control system.

2.02 COMPONENT SPECIFICATIONS

A. General

1. Where separate enclosures are indicated, enclosures shall be corrosion resistant welded NEMA Type 4X stainless steel for outdoor locations, NEMA Type 12 for indoor locations. Enclosure shall be fabricated from 316 stainless steel. Units shall include a single gasketed front door. Full height hinges, three (3) point latching handle with locking hasp and door restraints shall be included. Otherwise, provide enclosure as indicated in . All enclosures shall be UL listed.
2. Controls shall operate from a source of 120 Vac, 1 phase, 60 Hz UPS. All controls, radios, and telephone lines shall be protected from lightning or other transient voltages by power arresters and surge protectors on power lines, telephone lines, and radio coax cable.
3. Condensation protection shall be provided for panels not in climate-controlled environments. Enclosures shall have a heater, which operates continuously to prevent condensation build-up. A freeze protective heater and thermostat shall also be provided at those outdoor locations containing hydraulics. Where ambient temperatures (assume 100 degrees F) exceed component manufacturers specified maximum operating temperature by a factor of .85, cooling shall be supplied with the enclosure.
4. All DC power supplies required for operation of controller or instruments shall be provided. Units shall provide sufficient voltage regulation and ripple control to assure powered components can operate within their required tolerances. D.O. relay D.C. power supply shall have a separate UPS rated at 250 percent of the peak inrush of all D.O. relays activated simultaneously. Provide 120V, UPS circuit for power supply input.
5. Included shall be a battery backed UPS power source to run units for a period of twenty-four hours in the event of a failure of the normal AC source. Batteries shall be of the gel cell type and sized to provide power for the specified normal power fail period. The battery shall be kept fully charged using a regulated float voltage charging system. "Switching" type battery supplies are not acceptable. A fail output relay shall be provided and routed to alarm and PLC inputs.
6. Controller shall have an operational temperature range of 400 F to 1580 F, and a storage temperature range of -40°F to 176°F, under relative humidity conditions of 10% to 95% non-condensing.

7. All wiring shall be in complete conformance with the National Electrical Code, state, local and NEMA electrical standards. All incoming and outgoing wires shall be connected to numbered terminal blocks and all wiring neatly tied and fastened to chassis as required with non-adhesive clamps.
8. Outdoor controllers shall not have devices mounted in outer doors.

B. UL Labeling

1. Panels provided under this section shall meet the requirements of UL508. All panels shall bear the UL508 serialized label or be third party certified when delivered to the job site. All field modifications shall be in conformance with UL 508. When the Owner accepts the panels, the contractor certifies that the panels have retained their UL labeling or third party certification.

2.03 CONTROLLERS

A. General

1. Controllers shall be Modicon M340 (or higher level where indicated on plans) as manufactured by Schneider Electric, shall be provided for each indicated location in the system, and shall be installed as shown on the plan drawings or as otherwise directed by the Engineer. Listing of a Manufacturer does not relieve obligation of meeting all conditions on this specification. All PLC's, RTU's, and controllers shall be warranted by the manufacturer for a period of not less than three years from date of final acceptance by Owner.

2. Configuration

- a. Processor Rack: Include processor, power module, memory card, CPU display, communication modules and input/output modules.
- b. Expansion Rack: Include interface module, power module, micro memory card, communication modules, input/output modules and necessary connection cables.

B. Processor

1. The CPU shall have two RJ45 ports for programming and communications to all network devices. One port shall ethernet Modbus/TCP. One port shall be Modbus serial link. All devices shown on plans or described in specifications as connected to the LAN shall have ethernet connections to the network switch.

2. Internal User RAM: 4,096 KB
3. Integrated Data Memory: 3 MB
4. Power Consumption: 95 mA
5. Execution Time per Instruction, Bit Operations: 0.12 microseconds
6. Execution Time per Instruction, Floating Point Operations: 0.16 microseconds
7. Display LEDs: the following indicator and status LEDs shall be provided on the front of the CPU module at a minimum: RUN, ERR, I/O, SER COM, CARD ERR, ETH ACT, ETH STS, ETH 100
8. Storage Memory: Simatic Memory Card, at least 128 MB

C. Power Supply

1. The Programmable Controller shall operate in compliance with an electrical service of 85 to 265 VAC single phase, in the frequency range from 47 to 63 Hz, or DC power in ranges 108 to 132 VDC or 16.8 to 31.2 VDC
2. The manufacturer shall be able to provide as standard equipment a system power supply capable of converting above mentioned incoming voltages to the DC power required to operate the Programmable Controller system.
3. A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Other power supplies shall provide power to remotely located racks.
4. The power supply shall automatically shut down the Programmable Controller system whenever its output power is detected as exceeding 125% of its rated power.
5. The power supply shall monitor the incoming line voltage for proper levels. The system shall function properly within the above mentioned voltage ranges.
6. In addition, the power supply shall provide surge protection, isolation, and outage carry-over for a minimum of 5 ms for any power connection type.

7. Design features of the Controller power supply shall include a diagnostic indicator mounted in a position to be easily viewed by the user. This indicator shall provide the operator with the status of the DC power applied to the backplane. In addition, a means of disabling power to the CPU shall be possible from a power disconnect switch mounted in a position easily accessible by the operator.
8. At the time of power-up, the power supply shall inhibit operation of the processor and I/O modules until the DC voltages of the backplane are within specifications.
9. In addition to the electronic protection described above the power supply shall offer a failsafe fuse that is not accessible by the customer.

D. Input and Output Modules

1. General
 - a. All I/O shall be protected with miniature circuit breakers. Fuses are not allowed.
 - b. I/O modules shall be plugin mounted to the I/O mounting bases. I/O modules shall be designed to allow insertion at any point on the mounting base.
 - c. Each module shall have LED indicator to show I/O status, module health, and communication status.
2. Discrete inputs
 - a. Nominal Input Voltage of 120Vac or 24VDC as required
 - b. Provide 16 points per module
3. Discrete Outputs
 - a. Output Voltage Rating of 10-265Vac or 5-125VDC
 - b. Output Current Rating
 - 1) 2.5A max per point
 - 2) 16A max per module
 - c. Provide 16 points per module

- d. Isolated dry relay contacts will be furnished for all discrete outputs – Interposing relays will be furnished will be furnished to the I/O module.
- 4. Analog Inputs
 - a. Input Range of 4-20 mA
 - b. Resolution of approximately 16 bits across range
 - c. Provide individual isolators, in addition to the surge suppression devices specified, for all signals that enter the panel from outside the building. Substitution of Isolated Analog cards to meet this requirement is acceptable.
 - d. Provide 8 points per module
- 5. Analog Outputs
 - a. Output Current Range of 4 to 20 mA
 - b. Current Resolution of 12 bits across 20 mA
 - c. Calibration Accuracy - Better than 0.1% of range from 4mA to 20 mA
 - d. Provide 8 points per module
- E. I/O Listing:
 - 1. Refer to attachment A for the Controller's I/O arrangement. Contact Systems Integration Engineer for conformation of the controller's final I/O assignment for each device prior to fabrication of controller panel and before connections are made. Failure to coordinate will be at expense of Contractor and at no additional cost to Owner or Systems Integration Engineer
 - 2. At least 25 percent (minimum of four) points of each type (AI, AO, DI, and DO) for future undefined use.

2.04 CONTROLLER SOFTWARE

- A. Provide PLC Manufacturers licensed copy of Ladder Logic or PLC Manufacturer's other acceptable, licensed, programming software and all other required software specifically applicable to controller and modules provided and ship to System Integration Engineer according to project schedule. Software package shall include all original manuals available from PLC manufacturer or other pre-approved supplier.
- B. All software licenses required to achieve the functionality described in the Specifications shall be provided.
- C. The software package shall allow on-line/off-line program development, annotation, monitoring, debugging, uploading, and downloading of programs to the PLCs.
- D. All required hardware (including cables, cable adapters, etc.) for connection to PLCs shall be furnished.
- E. The software package shall include a software license agreement allowing the Owner the right to use the software as required for any current or future modification, documentation, or development of the PLCs furnished for this project.
- F. The software shall be Microsoft Windows-based and run on the supplied computers
- G. The software shall include a security feature to prevent unauthorized personnel from modifying and downloading the programs.
- H. Provide an I/O simulator which allows the PLC application load program to be tested on a PC with simulated analog and digital inputs and outputs, allowing I/O testing and debugging to be performed in a safe, isolated environment without the need for running the PLC CPU and process I/O boards.

2.05 HUMAN MACHINE INTERFACE (HMI)

- A. Unless specifically noted, the HMI to the system CCU, RTU, or controller shall be provided by means of a 15.0 inch industrial panel PC and shall be a product of Maple Systems, Model PC415C with Intel Core i3 G630T 2.3GHz CPU processing, 4GB DDR3, 250GB hard drive, and with operating and programming instructions and software. The terminal screen shall display controller analog and digital input/output signal status in appropriate engineering units. Terminal shall allow changes to set points, control parameters, and outputs.

All changes by Operators shall be password protected. In addition to the controller displays, the terminal shall provide menu driven commands, communications status and statistics, alarm history and online help. Terminal shall communicate with the controller via an Ethernet interface or Ethernet crossover cable interface at the PLC LAN port.

A. Ports and Devices

1. The HMI Shall have one ethernet 10/100 Mbps for communications with control system.
2. The HMI shall have one serial port RS-232 for communications with control system
3. The HMI shall have a minimum of two USB ports.

B. HMI Software

1. Provide Maple Systems Web Studio Interface Software V8.0 Development (WEB-40520-NT) for Panel PC.
2. Provide InduSoft Web Studio V8.0 Runtime Package (Maple Systems Part Number WEB-40520-RT).
3. Provide Windows 7 Pro (embedded) with Panel PC.

2.06 SPARE PARTS

A. Spares and Expendables Recommendations: The Contractor shall provide the spare parts under this contract.

1. CPU: Provide spare processor unit(s) for each model CPU installed.
2. Power Supply: Provide spare power supply for each model installed.
3. Memory Cards: Provide spares for each type of card installed.
4. I/O Cards: Provide spares for each unique I/O module type installed. Provide two or 10 percent of installed quantity, whichever is greater.
5. Network interface and communication modules: Provide one spare communication module for each unique communication module installed.

B. All parts to be in original protective packages and stored on site after acceptance by Engineer.

PART 3 EXECUTION

3.00 GENERAL

- A. Coordinate all work with the Engineer/Owner to avoid conflicts, errors, delays and unnecessary interference with operation of the existing system during installation, testing, cut-over and startup.
- B. Install all new equipment in accordance with the manufacturer's instructions and approved submittals.
- C. Provide adequate person-hour allowance for coordination with Systems Integration Engineer, Owner, other Sub-Contractors, and Controller Manufacturer.
- D. In addition to spare I/O's, provide additional 18 inches of DIN rail space for future use in control panels.
- E. See "Systems Acceptance" requirement in Specification Section 16012 – "Electrical Work," Item 3.03.

3.01 PROGRAMMING PERIOD

- A. Contractor shall install controller and peripheral devices in a timely manner so as to allow the following time periods for program installations:
 - 1. Controller: Allow a minimum of 20 working days for downloading and testing. Provide 4 weeks advance notice.
- B. Failure to meet these schedules will be at expense of Contractor and at no additional cost to Owner. Project completion delays caused by Contractor's failure to meet these scheduled periods are at Contractor's risk and expense and at no additional cost to Owner.
- C. See Specification Section 16012 – "Electrical Work," Item 3.08 – "Testing and Startup," for additional information on shop testing requirements.
- D. Note that all field inspections will be made when Contractor notifies Programmer that system is fully operational and ready for testing. This inspection will be prior to any programming work. Where system is determined to not be properly operational, the Engineer will notify Contractor of corrective action required before programming activity will commence. Contractor is solely responsible for any contractor delays where system is not ready for programming.

3.02 TESTING AND STARTUP

- A. All elements of the control system shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification. All special testing of materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner and Systems Integration Engineer. As a minimum, the testing shall include both a factory test and a field test. Testing requirements are as follows:
1. Factory Tests: The controller and all other associated hardware shall be tested via a full simulation at the factory, prior to shipment, so as to demonstrate that each component is operational and meets the requirements of these specifications. Provide a “Test Routine” type program for shop testing I/O wiring and interconnect wiring of components. Test results shall be certified, with written documentation provided to the Engineer upon test completion. Factory testing may be witnessed by the Engineer.
 2. Field Tests: All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly. Witnessed field tests shall be performed on the complete system. Contractor shall provide a checklist for all electrical, control and instrumentation functions and send to Engineer for approval. Each function shall be demonstrated to the satisfaction of the Owner and Engineer on a paragraph-by-paragraph basis. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion. The Contractor shall notify the Owner at least two (2) weeks prior to the commencement date of the field tests. After tests are completed and with system fully operational, system shall run continuously for a period of 90 days without failure. Any failures shall be repaired and test shall start over again.
 3. Prior to loading PLC or SCADA programming and prior to any PLC or SCADA set up by programmer, an inspection may be conducted by Engineer’s Inspector to assure electrical controls are functioning properly. Any discrepancies or problems shall be corrected and then Contractor shall send a written notice that complete electrical control system is installed and operating per the Plans and Specifications. This notice shall be signed by an Officer of the General Contractor’s company.
 4. Prior to testing system of PLC programs or HMI programs provided by other than the Systems Integration Engineer noted in Item 1.01 – “Work Included” all programs shall be furnished on CD for review by Engineer. Provide any special software necessary to run and test complete program.

3.03 TRAINING

- A. The training program shall be conducted by the Controller Manufacturer's Representative or, pre-approved qualified Instructor or approved, qualified Instructor and shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied. The training program shall consist of the equivalent of two (2) 8-hour days and conforming to Owner's schedule of operators. Only field site sessions shall be provided. At least 2 weeks prior to the requested start of the program, the proposed dates of training shall be submitted to the Owner and the Engineer for approval.
- B. The Training Instructor shall provide all instructional course material, equipment, and manuals to conduct the training program. Owner shall provide facilities for the training.
- C. The training program shall be conducted as follows:
 - 1. Initial training shall familiarize the student with the fundamental operation of any microprocessors, operating systems, software programs, and programming languages installed in this project.
 - 2. Operator training shall be conducted utilizing the actual system.
 - 3. Maintenance training shall address each item of equipment being supplied down to the individual module, board, or card level.
 - 4. Programming or configuration training shall, as a minimum, address; graphic display creation and editing; ladder diagrams; special housekeeping requirements; configuration of all specified functions; and the addition of new equipment to the system.
 - 5. The training shall provide Owner personnel with basic proficiency in operator interface unit functions pertaining to the specified system.
 - 6. A minimum of 75 percent of training time shall be dedicated to actual operation and use of the control system as encountered in day-to-day operations.
 - 7. Engineer's representative may be present during training.

8. The Controller Training Instructor shall provide a professional written and published training manual for Owner's use during training classes. Provide four (4) copies for Engineer and Owner's approval four (4) weeks prior to training. Provide six (6) copies for training after approval. Manual shall be professionally bound.

PART 4 WARRANTY

4.00 GENERAL

- A. Contractor shall provide full 3-year service warranty on the overall installation, and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written "Final Acceptance" of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor's warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed. Where Manufacturer's products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its effect on the product. Contractor is fully responsible for assuring that product manufacturers are aware of this condition and that manufacturer's warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor's expense and at no additional cost to the Owner.
- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.
- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

PART 5 PLC I/O LIST

5.01 PLC INPUT/OUTPUT LIST

- A. Use attached I/O List as follows for bidding purposes. Engineer will confirm at time of Submittals.

Module	Slot	Point	Description	Address	Note
Di 0	4	0	Spare	I 0.0	<i>Spare</i>
Di 0	4	1	Spare	I 0.1	<i>Spare</i>
Di 0	4	2	Spare	I 0.2	<i>Spare</i>
Di 0	4	3	Spare	I 0.3	<i>Spare</i>
Di 0	4	4	Spare	I 0.4	<i>Spare</i>
Di 0	4	5	Spare	I 0.5	<i>Spare</i>
Di 0	4	6	Spare	I 0.6	<i>Spare</i>
Di 0	4	7	Spare	I 0.7	<i>Spare</i>
Di 0	4	8	Spare	I 1.0	<i>Spare</i>
Di 0	4	9	Spare	I 1.1	<i>Spare</i>
Di 0	4	10	Spare	I 1.2	<i>Spare</i>
Di 0	4	11	Spare	I 1.3	<i>Spare</i>
Di 0	4	12	Spare	I 1.4	<i>Spare</i>
Di 0	4	13	Spare	I 1.5	<i>Spare</i>
Di 0	4	14	Spare	I 1.6	<i>Spare</i>
Di 0	4	15	Spare	I 1.7	<i>Spare</i>
Module	Slot	Point	Description	Address	Note
Di 1	5	0	Spare	I 2.0	<i>Spare</i>
Di 1	5	1	Spare	I 2.1	<i>Spare</i>
Di 1	5	2	Spare	I 2.2	<i>Spare</i>
Di 1	5	3	Spare	I 2.3	<i>Spare</i>
Di 1	5	4	Spare	I 2.4	<i>Spare</i>
Di 1	5	5	Spare	I 2.5	<i>Spare</i>
Di 1	5	6	Spare	I 2.6	<i>Spare</i>
Di 1	5	7	Spare	I 2.7	<i>Spare</i>
Di 1	5	8	Spare	I 3.0	<i>Spare</i>
Di 1	5	9	Spare	I 3.1	<i>Spare</i>
Di 1	5	10	Spare	I 3.2	<i>Spare</i>
Di 1	5	11	Spare	I 3.3	<i>Spare</i>
Di 1	5	12	Spare	I 3.4	<i>Spare</i>
Di 1	5	13	Spare	I 3.5	<i>Spare</i>
Di 1	5	14	Spare	I 3.6	<i>Spare</i>
Di 1	5	15	Spare	I 3.7	<i>Spare</i>

Module	Slot	Point	Description	Address	Note
Di 2	6	0	Spare	4.0	<i>Spare</i>
Di 2	6	1	Spare	4.1	<i>Spare</i>
Di 2	6	2	Spare	4.2	<i>Spare</i>
Di 2	6	3	Spare	4.3	<i>Spare</i>
Di 2	6	4	Spare	4.4	<i>Spare</i>
Di 2	6	5	Spare	4.5	<i>Spare</i>
Di 2	6	6	Spare	4.6	<i>Spare</i>
Di 2	6	7	Spare	4.7	<i>Spare</i>
Di 2	6	8	Spare	5.0	<i>Spare</i>
Di 2	6	9	Spare	5.1	<i>Spare</i>
Di 2	6	10	Spare	5.2	<i>Spare</i>
Di 2	6	11	Spare	5.3	<i>Spare</i>
Di 2	6	12	Spare	5.4	<i>Spare</i>
Di 2	6	13	Spare	5.5	<i>Spare</i>
Di 2	6	14	Spare	5.6	<i>Spare</i>
Di 2	6	15	Spare	5.7	<i>Spare</i>
Module	Slot	Point	Description	Address	Note
Di 3	7	0	Spare	6.0	<i>Spare</i>
Di 3	7	1	Spare	6.1	<i>Spare</i>
Di 3	7	2	Spare	6.2	<i>Spare</i>
Di 3	7	3	Spare	6.3	<i>Spare</i>
Di 3	7	4	Spare	6.4	<i>Spare</i>
Di 3	7	5	Spare	6.5	<i>Spare</i>
Di 3	7	6	Spare	6.6	<i>Spare</i>
Di 3	7	7	Spare	6.7	<i>Spare</i>
Di 3	7	8	Spare	7.0	<i>Spare</i>
Di 3	7	9	Spare	7.1	<i>Spare</i>
Di 3	7	10	Spare	7.2	<i>Spare</i>
Di 3	7	11	Spare	7.3	<i>Spare</i>
Di 3	7	12	Spare	7.4	<i>Spare</i>
Di 3	7	13	Spare	7.5	<i>Spare</i>
Di 3	7	14	Spare	7.6	<i>Spare</i>
Di 3	7	15	Spare	7.7	<i>Spare</i>

Module	Slot	Point	Description	Address	Note
Di 4	8	0	Spare	I 8.0	<i>Spare</i>
Di 4	8	1	Spare	I 8.1	<i>Spare</i>
Di 4	8	2	Spare	I 8.2	<i>Spare</i>
Di 4	8	3	Spare	I 8.3	<i>Spare</i>
Di 4	8	4	Spare	I 8.4	<i>Spare</i>
Di 4	8	5	Spare	I 8.5	<i>Spare</i>
Di 4	8	6	Spare	I 8.6	<i>Spare</i>
Di 4	8	7	Spare	I 8.7	<i>Spare</i>
Di 4	8	8	Spare	I 9.0	<i>Spare</i>
Di 4	8	9	Spare	I 9.1	<i>Spare</i>
Di 4	8	10	Spare	I 9.2	<i>Spare</i>
Di 4	8	11	Spare	I 9.3	<i>Spare</i>
Di 4	8	12	Spare	I 9.4	<i>Spare</i>
Di 4	8	13	Spare	I 9.5	<i>Spare</i>
Di 4	8	14	Spare	I 9.6	<i>Spare</i>
Di 4	8	15	Spare	I 9.7	<i>Spare</i>
Module	Slot	Point	Description	Address	Note
Di 5	9	0	Spare	I 10.0	<i>Spare</i>
Di 5	9	1	Spare	I 10.1	<i>Spare</i>
Di 5	9	2	Spare	I 10.2	<i>Spare</i>
Di 5	9	3	Spare	I 10.3	<i>Spare</i>
Di 5	9	4	Spare	I 10.4	<i>Spare</i>
Di 5	9	5	Spare	I 10.5	<i>Spare</i>
Di 5	9	6	Spare	I 10.6	<i>Spare</i>
Di 5	9	7	Spare	I 10.7	<i>Spare</i>
Di 5	9	8	Spare	I 11.0	<i>Spare</i>
Di 5	9	9	Spare	I 11.1	<i>Spare</i>
Di 5	9	10	Spare	I 11.2	<i>Spare</i>
Di 5	9	11	Spare	I 11.3	<i>Spare</i>
Di 5	9	12	Spare	I 11.4	<i>Spare</i>
Di 5	9	13	Spare	I 11.5	<i>Spare</i>
Di 5	9	14	Spare	I 11.6	<i>Spare</i>
Di 5	9	15	Spare	I 11.7	<i>Spare</i>

Module	Slot	Point	Description	Address	Note
Di 6	9	0	Spare	I 12.0	<i>Spare</i>
Di 6	9	1	Spare	I 12.1	<i>Spare</i>
Di 6	9	2	Spare	I 12.2	<i>Spare</i>
Di 6	9	3	Spare	I 12.3	<i>Spare</i>
Di 6	9	4	Spare	I 12.4	<i>Spare</i>
Di 6	9	5	Spare	I 12.5	<i>Spare</i>
Di 6	9	6	Spare	I 12.6	<i>Spare</i>
Di 6	9	7	Spare	I 12.7	<i>Spare</i>
Di 6	9	8	Spare	I 13.0	<i>Spare</i>
Di 6	9	9	Spare	I 13.1	<i>Spare</i>
Di 6	9	10	Spare	I 13.2	<i>Spare</i>
Di 6	9	11	Spare	I 13.3	<i>Spare</i>
Di 6	9	12	Spare	I 13.4	<i>Spare</i>
Di 6	9	13	Spare	I 13.5	<i>Spare</i>
Di 6	9	14	Spare	I 13.6	<i>Spare</i>
Di 6	9	15	Spare	I 13.7	<i>Spare</i>
Module	Slot	Point	Description	Address	Note
Do 0	7	0	Spare	Q 0.0	<i>Spare</i>
Do 0	7	1	Spare	Q 0.1	<i>Spare</i>
Do 0	7	2	Spare	Q 0.2	<i>Spare</i>
Do 0	7	3	Spare	Q 0.3	<i>Spare</i>
Do 0	7	4	Spare	Q 0.4	<i>Spare</i>
Do 0	7	5	Spare	Q 0.5	<i>Spare</i>
Do 0	7	6	Spare	Q 0.6	<i>Spare</i>
Do 0	7	7	Spare	Q 0.7	<i>Spare</i>
Do 0	7	8	Spare	Q 1.0	<i>Spare</i>
Do 0	7	9	Spare	Q 1.1	<i>Spare</i>
Do 0	7	10	Spare	Q 1.2	<i>Spare</i>
Do 0	7	11	Spare	Q 1.3	<i>Spare</i>
Do 0	7	12	Spare	Q 1.4	<i>Spare</i>
Do 0	7	13	Spare	Q 1.5	<i>Spare</i>
Do 0	7	14	Spare	Q 1.6	<i>Spare</i>
Do 0	7	15	Spare	Q 1.7	<i>Spare</i>

Module	Slot	Point	Description	Address	Note
Ai 0	8	0	Spare	PIW 256	4-20mA Scale=0- ___ FT
Ai 0	8	1	Spare	PIW 258	4-20mA Scale=0- ___ PSI
Ai 0	8	2	Spare	PIW 260	4-20mA Scale=0- ___ GPM
Ai 0	8	3	Spare	PIW 262	4-20mA Scale=0- ___ FT
Ai 0	8	4	Spare	PIW 264	4-20mA Scale=0- ___ ips
Ai 0	8	5	Spare	PIW 266	4-20mA Scale=0- ___ ips
Ai 0	8	6	Spare	PIW 268	4-20mA Scale=0- ___ in
Ai 0	8	7	Spare	PIW 270	4-20mA Scale=0- ___ in
Module	Slot	Point	Description	Address	Note
Ai 1	9	0	Spare	PIW 272	4-20mA Scale=0- ___ FT
Ai 1	9	1	Spare	PIW 274	4-20mA Scale=0- ___ FT
Ai 1	9	2	Spare	PIW 276	4-20mA Scale=0- ___ FT
Ai 1	9	3	Spare	PIW 278	4-20mA Scale=0- 60 HZ
Ai 1	9	4	Spare	PIW 280	4-20mA Scale=0- ___ ips
Ai 1	9	5	Spare	PIW 282	4-20mA Scale=0- ___ FT
Ai 1	9	6	Spare	PIW 284	-
Ai 1	9	7	Spare	PIW 286	-
Module	Slot	Point	Description	Address	Note
Ao 0	10	0	Spare	PQW 288	4-20mA Scale=0- 60 HZ
Ao 0	10	1	Spare	PQW 290	-
Ao 0	10	2	Spare	PQW 292	-
Ao 0	10	3	Spare	PQW 294	-
Ao 0	10	4	Spare	PQW 296	-
Ao 0	10	5	Spare	PQW 298	-
Ao 0	10	6	Spare	PQW 300	-
Ao 0	10	7	Spare	PQW 302	-

END OF SECTION

SECTION 16911
POWER MONITOR

PART 1 GENERAL

1.00 CONDITIONS

- A. Not Used
- B. Refer to Section 16012 - "Electrical Work" for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor's expense. See Section 16012 - "Electrical Work", Item 1.04 - "Submittals" for submittal requirements.

1.01 SUMMARY

- A. The Contractor shall furnish and install the Power Monitor equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings.

1.02 REFERENCE STANDARDS AND PUBLICATIONS

- A. General: The latest edition of the following standards and publications shall comply with the work of this section:
 - 1. ANSI/IEEE C12.20
 - 2. National Fire Protection Association, NFPA 70 - National Electrical Code
 - 3. National Electrical Manufacturer's Association
 - 4. ISO 9001, Quality Management Requirements

1.03 MANUFACTURER QUALIFICATIONS

- A. Eaton/Cutler Hammer shall be the basis of design. All products submitted shall comply with, meet, or exceed the specifications of the Eaton model type specified herein. Equal products as pre-approved are acceptable. See section 2.00 of this specification.
- B. The Manufacturer of the assembly shall be the Manufacturer of the major components within the assembly.
- C. For the equipment specified herein, the Manufacturer shall be ISO 9001 or 9002 certified.
- D. The Manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of 5 years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.04 WARRANTY

- A. Contractor shall provide full 5-year service warranty on the overall installation and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written "Final Acceptance" of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor's warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed. Where Manufacturer's products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its affect on the product. Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor's expense and at no additional cost to the Owner.

- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.

- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.

1.05 SUBMITTALS

- A. The Power Monitor submittals shall include, but shall not be limited to, the following information:
 - 1. Data for each type indicating conductor sizes, conductor types, and connection configuration and lead lengths
 - 2. Manufacturer's certified test data indicating the ability of the product to meet or exceed requirements of this specification
 - 3. Drawings, with dimensions, indicating mounting arrangement and lead length configuration, and mounting arrangement of any optional remote diagnostic equipment and assemblies
 - 4. List and detail all protection systems such as fuses, disconnecting means and protective materials
 - 5. Include installation details demonstrating mechanical and electrical connections to equipment to be monitored.

- B. Refer to 16013 Electrical Submittals for additional requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with Manufacturer's instructions. One (1) copy of Manufacturer's instructions shall be included with the equipment at time of shipment.

1.07 OPERATION AND MAINTENANCE (O&M) MANUALS & RECORD DRAWINGS

- A. O&M manuals shall be provided in accordance to 16014 Electrical O&M Manuals.

PART 2 PRODUCTS

2.00 MANUFACTURERS

- A. Eaton Cutler-Hammer
- B. Schneider Electric
- C. Pre-approved equal

2.01 Power Monitor – Service Entrance

- A. Provide a microprocessor based Power Quality Meter equal or better:
 - 1. Power Xpert PXM4000 with Webserver and Modbus TCP
- B. Electrical Requirements:
 - 1. Unit Operating Voltage – Refer to drawings for operating voltage and unit
 - 2. Power Monitor Requirements
 - 3. The device shall be capable of monitoring the following with a minimum accuracy of 0.5% of reading:
 - 4. Voltage (L-L and L-N)
 - 5. Amperes (all phases)
 - 6. Watts, Vars, VA
 - 7. Power Factor
 - 8. Frequency
 - 9. Var-Hours, VA-Hours
 - 10. Ampere-demand, Watt-demand, VAR-demand, VA-Demand

11. The device shall be capable of monitoring the following advanced parameters with all readings having a minimum accuracy of +/- 0.2%:
 - a. Individual Harmonics to the 40th harmonic
 - b. Total Harmonic Distortion (Voltage/Current)
 12. Capable of trend logging and analysis up to 100,000 events with timestamp
 13. The device shall be capable of recording the waveform with a minimum of 512 samples per cycle.
 14. The device shall have a current range of at minimum .1-200% of nominal.
 15. The device at a minimum shall have a display capable of 3 lines with 4 characters each, with indication of parameter being displayed.
- C. The meter shall be capable of providing the graphically display of the following Main Meter Menu Screens:
1. Meter Screen providing:
 - a. Volts: L-L and L-N, and average
 - b. Frequency
 - c. Current and average phase A, B, and C, N & G
 - d. Power Screen providing:
 - e. Energy
 - f. Demand
 - g. Power Factor
 - h. Quality Screen providing:
 - i. Total Harmonic Distortion (THD) of volts and current
 - j. Percent Nines (9s) reliability

2. Events screen providing:
 - a. Latest events
 - b. Enabled Triggers
 - c. Historical Events
 - d. Calendar view of Events
 - e. Events Timeline screen
 - f. Set-up screen providing:
 - g. View set-up
 - h. Edit set-up
 - i. Login
 - j. Logout
- D. Power Monitor – Communications
 1. The PQM shall be provided with multiple communications ports and protocols, including the following capability:
 2. RS-485 remote display port
 3. RS-485 Modbus RTU
 4. RJ-45 10/100 baseT Local Ethernet Configuration Port for local WEB server connection
 5. HTML web pages
 6. File transfer protocol (ftp)
 7. Modbus TCP
 8. SMTP(Simple Mail Transfer Protocol) for email support

9. SNMP(Simple Network Management Protocol) MIB support
 10. Ethernet TCP/IP
 11. NTP(Network Time Protocol) support
- E. The WEB server shall provide the user with remote WEB access to all the metered, trend and waveform information. The WEB server shall include real time monitored information in both numeric and graphical visual formats.
- F. Event Logging: The embedded WEB Server shall allow the user to view a list of triggered events along with event details. In addition, a separate system log shall store logging of activities including acknowledged triggers, and systems operations, such as resets. Storage shall be reserved for 100,000 events.
- G. No additional software shall be required to access data or modify settings.

PART 3 EXECUTION

3.00 INSTALLATION

- A. The Manufacturer shall submit a written statement indicating that a factory technician has inspected the installation. The installing contractor shall submit a checkout memorandum to the manufacturer. The memorandum shall indicate the date the equipment is placed into service and the actual method of installation. Submit three copies to the specifying engineer.
- B. The installation of devices within or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.
- C. The contractor shall follow the Device Manufacturer's recommended installation practice as found in the equipment installation instructions.
- D. The installation shall adhere to all applicable codes.
- E. System setup, calibration, and testing shall be conducted by factory trained technician, or a factory approved, qualified, independent technician.

3.01 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.02 TRAINING

- A. Provide training for set-up, testing, programming and operation for Owners Operators. Engineer may attend training classes. Training to be performed by an experienced factory trained technician, or a factory approved, qualified, independent technician at Owners facilities.

END OF SECTION

SECTION 16936

PILOT AND MISCELLANEOUS CONTROL DEVICES

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. All equipment and devices shall be NEMA rated. IEC rated equipment and devices are not acceptable.
- D. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work,” for submittal requirements.

1.01 SUMMARY

- A. Section Includes:
 - 1. Pilot and control devices for instrumentation and control (I&C) system.
 - 2. Products listed are applicable where indicated on plans or required in other specifications.

PART 2 PRODUCTS

2.01 PUSHBUTTON/SELECTOR SWITCH CONTROL UNITS AND PILOT LIGHTS

- A. Manufacturers:
 - 1. Square D Class 9001, Type K
 - 2. Cutler-Hammer 10250T
 - 3. Allen Bradley 800T

4. Or, pre-approved equal
- B. Construction:
1. Heavy duty
 2. Watertight
 3. Oiltight
 4. Base mounting
 5. Flush panel mounting
 6. Size to mount in 30.5 mm diameter opening without adapter. Smaller units are not acceptable.
 7. Padlock attachments, where required, constructed of metal. Plastic material is not acceptable.
 8. Legend plates, as required, for type of operation or as specified elsewhere.
- C. Pushbuttons:
1. Flush head unless specified elsewhere.
 2. Contact Blocks:
 - a. Double break silver contacts
 - b. AC Ratings: 7,200 VA make, 720 VA break
 - c. Single pole, double throw or double pole, single throw
 - d. Up to six (6) tandem blocks
 3. Maintained contact unless specified elsewhere.
 4. Non-illuminated.
 5. Legend plates, as required, for type of operation or as specified elsewhere.

D. Selector Switches:

1. Maintained position unless specified elsewhere
2. Contact Blocks:
 - a. Double break silver contacts
 - b. AC Rating: 7,200 VA make, 720 VA break
 - c. Single pole, double throw or double pole, single throw
 - d. Up to six (6) tandem blocks
3. Operators:
 - a. Number of positions as specified elsewhere
 - b. Standard knob type unless specified elsewhere

E. Pilot Lights:

1. LED, high visibility type
2. Colored lenses as specified elsewhere
3. Interchangeable lenses
4. Push to test
5. Legend plates as specified elsewhere

F. Enclosures:

1. Mounted in control or instrument panel as specified elsewhere
2. Control Station:
 - a. Environment:
 - 1) NEMA 12 in general areas
 - 2) NEMA 4X 316 stainless steel in wet locations or outdoors.
 - b. Flush or surface mounted as specified elsewhere.

- 1) Provide flush mounted pull box.

G. Nameplates:

1. MCC: Section 16482 – “Motor Control Centers (600 Volts or Less)”
2. Control Stations:
 - a. Engraved laminated plastic
 - b. Letters 3/16 in. high
 - c. White letters on black background
 - d. Identify per equipment controlled

2.02 MOTOR STARTER CONTROL RELAYS

A. Manufacturers:

1. Square D
2. Cutler Hammer
3. Or pre-approved equal

B. Construction:

1. Industrial type
2. 300 V rated
3. AC operation
4. Pressure wire connectors

C. Operating Data:

1. Pickup Time: 11 ms maximum
2. Dropout Time: 6 ms maximum

D. Coil:

1. Molded construction

2. 120 VAC, 60 Hz
 3. Continuous rated
 4. Color coded to indicate status
 5. Pilot duty
 6. 60A make, 6A break, (120 V inductive)
- E. Contacts:
1. Double break
 2. Silver alloy
 3. Convertible
 4. Color coded to indicate status
 5. Pilot duty
 6. 60A make, 6A break, (120V inductive)
- F. Track mounting capability.
- G. Accessories:
1. Add-on pole attachment:
 - a. 4 NO and 4 NC contacts
 - b. Add-on to 0 to 4 pole relay
 2. Latch attachment.
 3. Pneumatic Timer Attachment:
 - a. Single pole, double throw, double break timed contact.
 - b. Adjustable 0.2 to 60 sec.
 - c. Repeat accuracy of ± 15 percent.
 - d. Convertible timing mode.

4. Transient Timing Mode: Suppress coil transients to 300 V or less.

H. All relays to be 4PDT type.

2.03 CONTROL RELAYS

A. Manufacturers:

1. Potter and Brumfield
2. Struthers Dunn
3. Or pre-approved equal

B. Operating Data:

1. Pickup Time: 13 ms maximum.
2. Dropout Time: 10 ms maximum.
3. Operating Temperature: -45°C to 70°C.

C. AC Coil:

1. 120 or 240 Vac.
2. Continuous rated
3. 3.5 VA inrush
4. 1.2 VA sealed
5. 50 to 60 Hz
6. Minimum Dropout Voltage: 10% of coil rated voltage.

D. DC Coil:

1. 24 or 120 Vdc.
2. Continuous rated
3. Minimum Coil Resistance
 - a. 24 Vdc: 450 ohm

- b. 120 Vdc: 9,000 ohm
 - E. Contacts:
 - 1. Silver cadmium oxide for 1 amp or less resistive load
 - 2. Gold flashed fine silver, gold diffused
 - 3. 4 Form C
 - 4. 120 VAC
 - 5. 20 amp make, 1.5 amp break (inductive)
 - F. Rated at 10 million operations
 - G. Plug-in sockets
 - H. Enclosed and protected by polycarbonate cover
 - I. Provide relay retaining clips.
 - J. All relays to be 4PDT type.
- 2.04 TIME DELAY RELAY
- A. ATC # 319D-016, with 2 SPDT switches rated 5 amps at 120 Volt, contacts and coil, plug in base and socket, 5 ranges, .02 seconds to 30 minutes.
 - B. AGASTAT #7022AC, Instantaneous open on energization, time delay close on de-energization. Time range 1.5 seconds to 15 seconds, 120 volt, 60 Hz
 - C. ATC Model #319D-134, with 2 S.P.D.T. switches rated 5 Amps at 120 Volt, contacts and coil, plug in base and socket, 3 ranges, .1 to 100 seconds.
 - D. Macromatic Industrial Controls, Model #TAA1U, with two (2) S.P.D.P. switches rated 3 amps at 250 volt contacts, 24-240VAC/DC coil, plug-in base, six (6) functions, sixteen (16) ranges, 0.5 seconds to 10 hours.
 - E. Or approved equal

2.05 ELAPSED TIME METER

A. Manufacturers:

1. Cramer #635G/HRS.
2. Digits: Five (5), non-resettable.
3. Power: 120 VAC, 60 Hz.

B. Manufacturers:

1. Cramer #635S surface mounted.
2. Digits: Five (5), non-resettable
3. Power: 120 VAC, 60 Hz

2.06 TIMERS

A. 24 Hour Clock Timer (Repeat Cycle):

1. Manufacturers:
 - a. Tork Time Controls
 - b. Intermatic
 - c. Or pre-approved equal
2. Mounting: Surface
3. Display: 24-hr LCD
4. Contacts: One (1) SPDT rated 20A
5. Set Points: 288 per 24 hr.
6. Skip Feature: 1 to 7-day adjustable
7. Minimum On-Off Time: 5 min.
8. Time cycle programmable by keypad
9. Power: 120 VAC, 60 Hz

- B. Interval/Duration Timer:
 - 1. Manufacturers: ATC or equal.
 - 2. Mounting: Plug-in with dust tight cover
 - 3. Type: Integrated circuit
 - 4. Range: As indicated on drawings
 - 5. Contacts: Two (2) DPDT contacts rated 10 amp
 - 6. Power: 120 VAC, 60 Hz.

2.07 PRESSURE SWITCHES

- A. Prosense PSD25 Series Pressure Switch, Model No. PSD25-OP-145H or other model as required. (Where shown on Plans.)
- B. Electronic, adjustable dials, pressure switch. Prosense Series PSD25 with factory cable.
- C. Bourdon Tube Pressure Switches with SPDT or DPDT mercury switch, adjustable dead band/differential, shall be used for all pump control and alarm applications. Size for range required. (Where shown on plans.)
- D. Mercoid Series DA and DS Bourdon Tube Pressure Switches, NEMA 4 weatherproof enclosure, manual reset, SPDT, mercury switch rated 4 amps at 120 volts. (Where shown on plans.)
- E. Mercoid Series BB Differential Pressure Switches, Bourdon Tube, SPDT, mercury switch rated 4 amps at 120 VAC. (Where shown on plans.)
- F. Mercoid Series PQ Ultra Sensitive Large Diaphragm Pressure Switches, where application requires.
- G. Honeywell Model L404A Pressure Switch 10-150 psi operating range, 8-16 psi subtractive differential, 120V, breaks on pressure rise. (Where shown on Plans.)
- H. Mercoid Series DA Model No. DRW-33-153L-7, 5-150 psi range, NEMA 4 weatherproof enclosure, manual reset, SPDT, mercury switch rated 4 amps at 120V. (Use all well discharge applications.)
- I. Mercoid Model No. DA-31-153-3A, 1/8 – 20 PSIG, brass bourdon tube, SPDT, mercury switch rated 4A at 120 VAC. (Where shown on Plans.)

- J. No exceptions for Manufacturer, series, or type switches without written approval.

2.08 EXTERIOR MOUNTED ALARM LIGHT

A. Manufacturers:

- 1. Edwards
- 2. Appleton Electric Company
- 3. Crouse Hinds
- 4. Or pre-approved equal

B. 120 VAC

C. Suitable for use in wet location, gasketed.

D. Cabinet mounted, provide mounting lugs. Body to include outlet box.

E. Aluminum mounting hood.

F. Red glass globe with guard.

G. ¾ inch conduit hubs

2.09 EXTERIOR MOUNTED ALARM HORN

A. Manufacturers:

- 1. Edwards
- 2. Or, pre-approved equal.

B. 120 VAC

C. Suitable for use in wet location, gasketed.

D. Cabinet mounted, provide mounting lugs. Body to include outlet box.

E. Aluminum mounting hood.

F. ¾ inch conduit hubs

2.10 ROTATING BEACON

A. Manufacturers:

1. Edwards: 40 Watts, 75 FPM, 120 Volt, 50-LMP, 4CW lamp red acrylic dome lens, Edwards #52R-N5-40W with wall mounted bracket Edwards #WBR.

2.11 ALTERNATOR

A. Manufacturers:

1. Diversified Electronics:

a. Two (2) Pump Duplexor:

- 1) 24 VAC/DC, ARA-24-ABA.
- 2) 48 VDC, ARA-48-ABA
- 3) 120 VAC/DC, ARA-120-ABA
- 4) 208 VAC, ARA-208-ABA
- 5) 240 VAC, ARA-240-ABA

b. Three (3) Pump Triplexor:

- 1) 24 V, ARA-24-AFE
- 2) 120 V, ARA-120-AFE

c. Four (4) Pump Quadraplexor:

- 1) 24 V, ARA-24-AGE
- 2) 120 V, ARA-120-AGE

d. Two (2)/Three (3) Pump Duplexor/Triplexor: 120 V, ARA-120-AME

e. Three (3)/Four (4) Pump Triplexor/Quadraplexor: 120 V, ARA-120-ANE

f. Five (5)-Pump Pentaplexor: 120 V, ARP-100

g. Six (6)-Pump Hexaplexor: 120 V, ARA-100

2. Time Mark Corporation: 120 V, B 471
 3. Macromatic Industrial Controls: Two (2) pump duplexor, 120 volt, ARP120A6, 240 volt, ARP240A6
 4. Or equal as pre-approved by Engineer
- B. Provide automatic alternation of energizing motor starters.
- C. Permit operation of units singly or together as called by pilot devices.
- D. N.O. auxiliary contacts from motor starters required to operate alternator.
- E. Alternator shall provide for operation of standby or lag unit through second pilot device in event of failure of lead unit or first pilot device or alternator coil.
- F. With pump selector switch for operation of two (2), three (3), four (4) and five (5) pump systems.

2.12 PHASE FAIL PROTECTION DEVICES

- A. Diversified Electronics Model #SLD-440-ALE, 480 Volt, 3 Phase.
- B. Diversified Electronics Model #SLD-220-ALE, 240 Volt, 3 Phase.
- C. Macromatic Industrial Controls, Model #PMDU, 208-480 Volt, 3 Phase
- D. Franklin Electric or Equal, Submonitor Model #5860005000, 190-600Volt, 3 Phase, with detachable display
- E. Franklin Electric or Equal, Submonitor Model #5860005100, 190-600 Volt, 3 Phase, with detachable display
- F. Franklin Electric or Equal, Submonitor Model #D3 Dwonload Tools, with software and USB cable

2.13 FLOW SWITCH

- A. Vane operated stainless steel switches with vane length sized to maximum diameter of pipe.
 1. Flowtect Series V4 Vane Operated Flow Switch, Model No. V4-SS-U-D for vertical mounting.

2. Flowtect Series V4 Vane Operated Flow Switch, Model No. V4-SS-2-U-D-V with upward flow option for horizontal mounting (vertical pipe with upflow.)
3. Static O Ring, Model No. 1520B-F5A-C-W1-EF-X, vertical mounting only.
4. Potter Model IFS-WP.
5. Or pre-approved equal.

B. Thermal mass sensing stainless steel flow sensor with controls.

1. Kaydem Instruments, CMP 112 and 115 Flow Switch

2.14 UNIVERSAL AC CURRENT SENSOR

A. Manufacturer:

1. Entrelec, SSAC, Inc. – P.O. Box 1000, Baldwin, NY, 13027
2. Or, approved equal.

B. TSC, ECS, ECSH, and ECSL Series: Provides relay contact closure when current reaches pre-set level.

C. Install per Manufacturer's instructions.

D. Sensor to be rated at 125% of current rating.

2.15 CURRENT TRANSDUCER

A. Manufacturers:

1. NK Technologies
2. Ohio Semitronics, Inc.
3. Or, approved equal

B. AT Series: Current transformer with signal conditioner. Split or solidcore as applicable. 420 model with 4–20 MA output. Self powered. 0 – 200 amp range. U.L. listed.

C. A.C. Current Transformer Model No. MCT5, 005E or 005E2 (as shown on plans) with Manufacturer's recommended CT rated per circuit maximum amps x 1.25.

- D. AT/ATR Series: 0 – 200 amp range or, as required by motor current rating.
- E. Transducer to be rated for 125% of voltage rating.
- F. Size unit to detect peak inrush current of motor.

2.16 VOLTAGE TRANSDUCER

- A. Manufacturer:
 - 1. Ohio Semitronics, Inc.
 - 2. Or, approved equal
- B. A.C. Voltage Transducer Model VT, rated per circuit maximum voltage x 1.25. Select version that matches shown on plans.
- C. Transducer to be rated for 125% of current rating.

2.17 FLOAT SWITCH

- A. Wastewater / Non-Potable Use:
 - 1. Manufacturers:
 - a. Anchor Scientific
 - b. Pre-approved equal.
 - 2. Construction:
 - a. Direct acting.
 - b. Polypropylene body.
 - c. Form C type contact mercury switch.
 - d. 10 amps at 230 VAC maximum.
- B. Potable Water Use:
 - 1. Manufacturer:
 - a. U.S. Filter

- b. Pre-approved equal
 - 2. Construction:
 - a. Model 9GEF, mercury free
- 2.18 DC INPUT, FIELD CONFIGURABLE ISOLATOR
 - A. Manufacturer:
 - 1. Action Instruments, Model ACTIONI/Q Q406
 - 2. Or, approved equal.
 - B. Construction:
 - 1. Provides one or two fully isolated DC output signals in proportion to one or two DC inputs.
 - 2. Field Configurable: 4-20 ma, 0-1 ma, 0-10V or 0-20 ma.
 - 3. 120 V power source.
- 2.19 SUBMERSIBLE LEVEL PROBE AND LEVEL RELAY
 - A. Level Probe:
 - 1. Manufacturer: ITT Flygt/MultiTrode Model 1.0/10-10M.
 - 2. Description: Submersible level sensing probe suspended from top of the wet well via power cable.
 - 3. Construction: Probe casing 1 ¼-inch epoxy filled PVC, sensor-Avesta 254 SM0 high-grade stainless steel alloy, cable PVC/PVC multi-core conductors (ten per probe).
 - B. Level Relay:
 - 1. Manufacturer: ITT Flygt/MultiTrode Model MTRA.
 - 2. Description: Level control relay for operation of pumps from the level probe input in the back up mode.

3. Display: Front face high intensity LED indication, power on (green), alarm on (red), and pump on (yellow).
4. Sensor: Three (3) inputs, 12 VDW, 0.8 mA max per sensor.
5. Sensitivity: 1K, 4K, 20K, and 80K ohms adjustable via dip switches.
6. Relay Output: Two (2) sets of NO output w/ adjustable time delay. Power requirements options for 240 VAC, 110 VAC, 24 VAC or 10-30 VDC.

2.20 SUBMERSIBLE LEVEL TRANSDUCER

I. Non-Potable Water Application:

A. Manufacturer:

1. CA Briggs
2. Mercoïd
3. Pre-approved equal

B. Model: Blue Ribbon Bird Cage Water Level Sensor – Model BC 001

C. Surge Protector Blue Ribbon Corp. Surge Protector Model BCP 3000

D. Power: 10 - 30 VDC

E. Output: 4-20 mA.

F. Accuracy: plus/minus 0.1 percent of calibrated span, minimum.

G. Range: 0.2 to 100 meters of H₂O, minimum.

H. Sensor: Flush mounted ceramic.

I. Heavy stainless steel body.

J. Cable: Heavy duty, submersible rated with strain relief device.

K. Cable Length: Wet well depth plus length to terminal box with 10 feet slack coiled in terminal box (not in wet wells).

L. Kellum grip with protective bushing. Suspend on stainless steel cable clear of pump and 4 inches above intake. Clamp transducer cable to stainless steel cable with suitable stainless steel clamps at 24-inch intervals. Provide epoxy coated lead weight at end of stainless steel cable. Provide stainless steel cable strain relief device at transducer that fits threaded connection at transducer, and that has ring for support by stainless steel cable.

II. Potable Water Application:

A. Manufacturer:

1. Dynotek
2. Pre-approved equal

B. Model: Slim Line

C. Power: 9 - 30 VDC

D. Output: 4 mA at 12.7 psi
20 mA at full scale.

E. Accuracy: plus/minus 0.25 percent of full scale B.L.S.

F. Pressure Range: 50, 100, 200, 350, 520, 750 and 1000 psi sealed gauge.

G. Diameter: 7.1 in.

H. Heavy stainless steel 316 L body.

I. Cable: Heavy duty shield 2 conductors, submersible rated with strain relief device. 0.30 in. TPE alloy jacket and kevlar 130 lb. min. tensile strength.

J. Cable Length: Well depth plus length to terminal box with 10 feet slack coiled in terminal box.

2.21 SIGNAL CONVERTER/ISOLATION AMPLIFIER

A. Manufacturers:

1. MCR-C Series manufactured by Phoenix Contact.
2. AKT Series manufactured by Wieland Manufacturing.

B. Voltage to current and current to voltage conversion.

C. Current to current isolation amplifier.

2.22 ETHERNET SWITCH – FIVE (5) PORT

A. Manufacturer and Model:

1. MOXA EDS-405, EDS-405-MM-SC and EDS-405-MM-ST
2. Or, approved equal.

B. Features:

1. Plug-n-Play, Ring Redundancy solution (recovery time < 300 ms)
2. 10/100BaseT(X) (RJ-45), 100BaseFX (SC optical fiber connector, Multi mode).
3. Support IEEE 802.3/802.3u/802.3x.
4. Store and Forward switching process type.
5. 10/100M, Full/Half-Duplex, MDI, MDI-X auto-sensing.
6. Power Failure, port break alarm by relay output.
7. Redundant dual DC power inputs.
8. Line-Swap Fast Recovery (patent pending).

C. Specifications:

1. Processing Type: Store and Forward.
2. Flow Control: IEEE 802.3x flow control, back pressure flow control.
3. RJ-45 Ports: 10/100BaseT(X) auto MDI-X negotiation speed, F/H duplex mode, and auto MDI/MDI-X connection.
4. Fiber Ports: 100BaseFX ports (SC connector & ST w/ adapter)
5. LED Indicators: Power, Faults, 10/100M, Ring Master.
6. DIP Switch: Port break alarm mask, Ring Master.

7. Alarm Contact: One relay output with current carrying capacity of 1A @ 24 VDC.
8. Optical Fiber:
 - a. Distance: Multi mode fiber for 2 km.
 - b. Wavelength: 1310 nm
 - c. Min. TX Output: -20 dBm (Multi)
 - d. Max. TX Output: -14 dBm (Multi)
 - e. Sensitivity: -34 to -30 dBm (Multi)
9. Power:
 - a. Input Voltage: 12 to 48 VDC, redundant inputs
 - b. Input Current (@ 24V): 0.35 A
 - c. Overload Current Protection: 1.1A
 - d. Connection: Removable 5-pin Terminal Block
 - e. Reverse Polarity Protection: Present
- D. Design:
 1. Operating temperature ranges from 0 to 60°C, or extended operating temperature from -40 to 75°C.
 2. IP30, rugged high-strength metal case.
 3. For hazardous location (CLASS 1 DIV. 2/ZONE 2)
 4. DIN-Rail or panel mounting ability.
- E. Execution:
 1. For additional parts, provide switch with similar characteristics.
 2. Provide Manufacturer's recommended power supply.

3. Install per Manufacturer's instructions.

F. Warranty: Five (5) years.

2.23 ETHERNET SWITCH – MULTI-PORT – (WHERE SHOWN ON PLANS)

A. Manufacturer and Model:

1. Sixnet Industrial Ethernet Switch:

- a. ET-GT-3ES-2SC or ST
- b. ET-GT-3ES-3SC or ST (L)
- c. ET-GT-5ES-1
- d. ET-GT-5ES-2SC or ST
- e. ET-GT-5ES-3CS or ST (L)
- f. ET-GT-5ES-4SC or ST
- g. ET-GT-5ES-5SC or ST (L)
- h. ET-GT-9ES-1
- i. ET-GT-9ES-2SC or ST
- j. ET-GT-9ES-3SC or ST (L)

2. Or, approved equal.

B. Features:

- 1. Plug-n-Play, Ring Redundancy solution (recovery time < 300 ms)
- 2. 10/100BaseT(X) (RJ-45), 100BaseFX (SC optical fiber connector, Multi mode).
Real-time auto detecting operation.
- 3. Support IEEE 802.3/802.3u/802.3x.
- 4. Unmanaged Store and forward switching process type.
- 5. 10/100M, Full/Half-Duplex, MDI, MDI-X auto-sensing.

6. Power Failure, port break alarm by relay output.
 7. Redundant dual DC power inputs.
 8. Line-Swap Fast Recovery
- C. Specifications:
1. Processing Type: Store and Forward.
 2. Compliant: IEEE 802.3 and 802.3u.
 3. RJ-45 Ports: 10/100BaseT(X) auto MDI-X negotiation speed, F/H duplex mode, and auto MDI/MDI-X connection.
 - a. Nine (9) RJ45 Ports
 - b. Eight (8) RJ45 and One (1) Fiber Port
 - c. Three (3) RJ45 and Two (2) Fiber Ports
 - d. Four (4) RJ45 and One (1) Fiber Port
 - e. Two (2) RJ45 and One (1) Fiber Port
 4. Fiber Ports: 100BaseFX ports dual SC connector or ST.
 5. Alarm Contact: One relay output with current carrying capacity of 1A @ 24 VDC.
 6. Optical Fiber:
 - a. Distance: Multi mode fiber for 2 km.
 - b. Wavelength: 1310 nm
 - c. Min. TX Output: -20 dBm (Multi)
 - d. Max. TX Output: -14 dBm (Multi)
 - e. Sensitivity: -34 to -30 dBm (Multi)

7. Power:
 - a. Input Voltage: 10 to 30 VDC, redundant inputs
 - b. Overload Current Protection
 - c. Connection: Terminal Block

D. Design:

1. Operating Temperature Ranges: -40 to 55 degrees Celsius.
2. Humidity: 5 to 95 percent RH
3. For hazardous location (CLASS 1 DIV. 2/ZONE 2)
4. DIN-Rail or panel mounting ability.

E. Execution:

1. For additional ports, provide switch with similar characteristics.
2. Provide Manufacturer's recommended power supply.
3. Install per Manufacturer's instructions.

F. Warranty: Five (5) years.

2.24 FLOW-NO-FLOW SWITCH

A. Manufacturer and Model:

1. Flow Technology Uniprobe Flow-No-Flow Switch
2. Or pre-approved equal.

B. Specifications:

1. Flow Threshold Switch Point
2. Maximum No-Damage Flow Velocity
3. Response Time
4. Switch Capacity

5. Switch Configuration
6. Operating Temperature Range
7. Maximum Operating Pressure
 - a. UP01
 - b. SP01
8. Power Required
9. Construction of 316 Stainless Steel
10. NEMA 4X or Explosion-Proof Enclosure
11. Omni-Directional Flow Sensing
12. Clean-In-Place
13. Operates in corrosive or abrasive liquids and gases.

2.25 PANEL GAUGES

- A. Provide front flange, flush, panel mounted 6-inch diameter and with lower back mount type.
- B. Range:
 1. Water Pressure: 0 to 150 psi.
 2. Ground Storage Tank Level: 0 to 50 feet.
 3. Other measured parameter range plus 25 percent.
- C. Accuracy: 1 percent or better.
- D. Manufacturers:
 1. Marshal Town
 2. Or approved equal.

2.26 INTRUSION SWITCHES

A. Doors:

1. On all entrance doors for alarm switch and, on MCC and control panel doors for intrusion or light operation, install Model E700, DPDT switch as manufactured by ERSCE except where shown otherwise on plans.
2. MicroSwitch, applicable model, where indicated on plans.
3. Special Applications:
 - a. Where indicated on Plans for loose fitted doors and/or for areas where subject to damage, install GRI Model 4400 magnetic switches with stainless steel cable.

B. Overhead Rollup Doors:

1. For overhead door applications, install ADEMCO Model 958-2 Magnetic OHD Contractor, or approved equal.

2.27 DC/DC CONVERTER

- A. Manufacturer and Model: AGM Electronics, Group 4000 or, as pre-approved in writing.
- B. Supply Voltage: 8 – 90 VDC.
- C. Load Drive: 0 – 350 ohms.
- D. 2 or 4 wire, as required.
- E. 4 - 20 ma or 8 – 10 vdc, as required for inputs and outputs.
- F. Accuracy: Plus/minus 0.1 percent calibration.
- G. Adjustable signal offset and span.
- H. Outputs: Multiple, as indicated on plans or as required for circuit application.
- I. See Manufacturer's data sheets for additional requirements.

2.28 POSITION/DISPLACEMENT SENSOR

- A. Sensor: Macro Sensors Model HSDR 750 Hermetically Sealed DC-LVDT Position Sensor and Loop Powered LVDT Positioned Transmitter.
1. DC-LVDT Sensor:
 - a. Plus/minus 15 VDC input, 0 to plus/minus 10 VDC output.
 - b. Non-linearity less than plus/minus 0.25 percent of FRO.
 - c. Range: Plus/minus 0.050 inch to plus/minus 10 inches.
 - d. Environmentally sealed to IEC IP.68.
 2. Loop Powered LVDT Transmitter:
 - a. 4 – 20 mA loop powered I/O.
 - b. Non-linearity less than plus/minus 0.5 percent of FRO.
 - c. Range: 1 inch to 10 inches.
 - d. Hermetically sealed for harsh environments.
- B. Macro Sensor DMC-A2-100 Dual Channel Controller: AC-LVDT controller with digital display and with RS232C/Ethernet/analog outputs.
- C. Macro Sensor Modular LVDT Signal Conditioner:
1. Model: LVC-2412.
 2. DIN rail mounting.
 3. 4 – 20 ma output or 0 – 10 VDC output.
 4. 12 vdc or 24 VDC operating voltage.
 5. Temperature Range: 0° F to 160° F.
 6. Install per Manufacturer's instructions.

D. Calibration and Settings:

1. Calibration to be performed by Factory Representative.
2. Field settings per Manufacturer's instructions.

E. For Cla-Val positioning and position indication applications use Cla-Val Models CRL-33 and X117D respectively.

2.29 MULTIPLE CHANNEL ISOLATED SWITCH

- A. Manufacturer: Diversified Electronics.
- B. Model: ISO and ISL Series.
- C. Contacts: SPST-N.O. per channel.
- D. Temperature Range: -4° F to 135° F.
- E. LED indicators for each output.

2.30 AC CURRENT TRANSDUCER

- A. Manufacturer: HCS.
- B. Model: CR4170 Series.
- C. Output: 4 – 20 mA or 0 – 5 VDC, as required.
- D. Three (3) element AC current.
- E. Calibration: True RMS sensing.
- F. Temperature Range: 0 to 50 degrees Celsius.

2.31 IMPEDANCE MATCHING TRANSFORMER

- A. Manufacturer: Hammond Manufacturing
- B. Model: 802 and 803E
- C. 50 ohm to 600 ohm

2.32 ELECTRONIC VIBRATION SENSOR/SWITCH

A. Manufacturer:

1. Robertshaw

B. Model:

1. 566-A2-E Velocity-Acceleration Vibration Monitor

C. Outputs:

1. One (1) SPST relay trip for alarm, one (1) SPST relay trip for shutdown, and 4-20 MA absolute analog signal.

D. Scale:

1. Coordinate with Pump/Motor Vendor for displacement ranges required.

E. Input Power:

1. 115 VAC, 60 Hz

F. Enclosure:

1. Epoxy coated NEMA 4

G. Lockout Feature:

1. Adjustable 15 second start up delay

H. Accessories:

1. Provide alarms as follows:
 - a. Alarm No. 1: Operates with adjustable time delay (0.5 to 15 seconds.) When a vibration signal continues to exceed the set point for as long as the time delay setting, the alarm actuates.
 - b. Alarm No. 2: Actuates when vibration signal exceeds set point. No time delay is available.
 - c. Latch Disable: Disables alarm latches. Alarms reset automatically when vibration level returns to normal from an alarm condition.

- I. Model 566 monitor, installed in SCADA cabinet door, or at each motor starter cabinet, as indicated on Plans.
- J. Input Signal:
 - 1. Velocity:
 - a. Low Range: 0 to 1.5 in./sec RMS
 - b. High Range: 0 to 3 in./sec RMS
 - 2. Acceleration:
 - a. Low Range: 0 to 5 G's RMS
 - b. High Range: 0 to 10 G's RMS
- K. Remote sensor for motor mounting.
- L. High temperature accelerometer/transmitter sufficient for use at motor housing temperature.
- M. Provide all necessary factory hardware for attachment to motor and for cable connections to junction box. Install sensors for both X and Y axis displacement on motor housing. Submit mounting detail for Engineer's approval.
- N. Provide program software to install in plant SCADA PC for analysis and trending of analog signal. To allow observation of entire frequency range of vibration transducer, filtering and gating of signal for display at operator's station. Program shall be furnished along with shop drawings and ready for SCADA programmer's use.

2.33 LIQUID LEVEL SENSOR

- A. Siemens Sitrans Model LC300
- B. 4-20 mA current loop circuit with power supply. Route to SCADA or controller I/O.
- C. Measure full depth of tank.
- D. Threaded or flange connection to match port or tank.
- E. Rod or rope probe with PFA jackets as applicable for conditions.
- F. Local LCD user interface where shown on plans.

2.34 SUBMERSIBLE PUMP PROTECTION MODULE

- A. Flight MiniCAS II: Model No. 83 58 57 (24 volt), 40-50 10 98 (120 volt); MiniCAS II/FUS Model No. 14-40 71 13 92 (24 volt).
- B. Module shall be capable of monitoring temperature via a thermal switch embedded in motor winding, and capable of detecting leakage via sensor located in pump.
- C. Temperature detection to operate Form “C” 10 amp contact, such that when wired into pump controls will shut down pump when over-temperature condition is detected.
- D. Leakage detection to operate Form “C” 10 amp contact, such that when wired into pump controls will initiate alarm.
- E. 20-30 VDC, 50-60 Hz with 24 volt external power supply, or 120 VAC, 5-60 control power source.
- F. LED indicators for over-temperature and leak indications.
- G. Manual reset pushbutton to interrupt power supply.
- H. Model No. 14-50 70 97 Socket
- I. Temperature Range: 0-50° C (32-123° F), Max 90% RH

2.35 MODBUS Ethernet Serial Server

- A. Manufacturer:
 - 1. B & B Electronics.
- B. Models:
 - 1. MESA1A, MES1B.
- C. Dimensions:
 - 1. MES1A/MES1B – 1.25 x 4.5 x 4.75 in (3.2 x 11.3 x 12.2 cm).
- D. Power Supply Requirements:
 - 1. 10VDC to 30VDC @ 3.6W.

- E. Power Consumption:
 - 1. 12VDC @300 mA.
- F. Operating Temperature:
 - 1. -20 to 80 °C (-4 to 176 °F).
- G. Humidity:
 - 1. 10% to 90% R.H. non-condensing.
- H. Ethernet:
 - 1. Single RJ-45 female (with built-in LED indicators).
 - 2. IEEE 802.3 10/100 Mbps auto-detecting, 10BaseT, 100BaseTX.
 - 3. TCP, UDP, DHCP, SNMP, TELNET, ICMP, ARP, TFTP, Modbus ASCII, Modbus RTU, Modbus/TCP
- I. Serial:
 - 1. 12V TVS for MES1A.
 - 2. MES1A – 9 pin D-type male (DB-9M).
 - 3. 5 V TVS for MES1B.
 - 4. MES1B removable screw terminal (5) block with screw down.
- J. Interface Lines Supported:
 - 1. MES1A – RS-232 TD, RD, GND.
 - 2. MES1B – RS-422-485 TDA(-), TDB(+), RDA(-), RDB(+), GND.
- K. Configuration Modes:
 - 1. Telnet, XPort Device Installer with integrated Telnet.
- L. Device Management:
 - 1. SNMP – RFC 1213-1215-1316-131.

2.36 LIGHTING CONTROL DEVICES

A. Photocells:

1. Provide photocell rated at 120 volt, 5 amp minimum, temperature range -40 to 150 degree F, weather proof outdoor use. Twist lock base where noted.
2. Manufacturers: Tork, GE, Woods or approved equal.

B. Lighting Contractors:

1. Provide multipole, 120/300/600 volt range as applicable with contacts rated at 10 to 100 amps as required by lighting load.
2. Manufacturers: Eaton, GE, Allen Bradley, or approved equal.

C. Enclosure:

1. Provide NEMA 1 enclosure for indoor use and NEMA 4X for outdoor use, or as indicated on plans. Outdoor enclosures to have no devices on outer door.

D. Selector Switches & Pilot Lights:

1. Provide Hand/Off/Auto selector switch as indicated on plans. See item 2.01 of this specification for acceptable manufacturers and models.

2.37 HYBRID VOLTAGE / CURRENT SENSOR MODULE

- A. Provide a solid state hybrid voltage/current sensor module equal in quality to Potter Brumfield CR Series unit, to control and monitor VFD driven submersible pumps in event of “over temperature” conditions as shown on control diagram sheet of the construction plans. This is a proprietary monitor and control scheme that is designed for this specific project only. It is intended for use with Flygt pumps only and may not provide the protection required with other pump controls.

This control circuit replaces the standard Mini Cas unit provide with Flygt pumps and may not function with other manufactures pumps.

- B. The pump shall be ordered without the standard Leak Detector system when this specific method of control is used. The pump shall contain only the temperature sensor switch manufactured by Thermik and installed inside pump by Flygt.

- C. The controls shall operate in a manner as follows for VFD operated pumps:
1. Provide solid state hybrid voltage/current sensor module as manufactured by Potter Brumfield or equal for use with 12vdc power to pump motor temperature sensor model SO6-140.05 manufactured by Thermik as supplied installed in Flygt grit pump. Circuit shall operate to sense current flow thru the temperature sensor and output a 4-20 am signal over a calibrated range that allows the SCADA PLC to determine motor temperature based on current flow. In addition, the sensor module shall provide a discrete signal output when sensor current is zero, indicating the sensor switch has opened at the high temperature limit setpoint. The sensor will reset internally when the motor temperature decreases as the motor cools.
 2. The control circuit shall Lock Out when the sensor switch opens on high temperature, and requires operator manual reset before pump will restart. Contacts will inhibit the motor control circuit and also send an alarm to the control panel indicator light and to the SCADA PLC.
 3. The 4-20 ma signal to the SCADA AO module shall be calibrated to temperature of each specific pump sensor. The PLC can inhibit the motor controls at any time before the temperature sensor switch is opened, and shall lock out the PLC pump VFD Call signal until reset at the PLC.

This allows two means to stop the pump in event temperature rise is greater than set at the PLC, or greater than the operating point of the temperature sensor internal switch to assure pump temperature is not ever excessive at any VFD controlled speed.

4. The sensor circuit shall operate in same in Hand or Auto control of the pump. The temperature monitoring circuit will be powered up when the pump HOA switch is turned to the Hand or Auto position. The circuit shall have a settling time after initiation of the activation relay as shown on the pump control diagram. The pump start time delay relay shall be set a value not less than the time it requires for the over temperature circuits to be fully activate to assure the pump Call controls function normally when the HOA switch is set. When the pump HOA is Off or when a specific pump VFD breaker is turned off, the over temperature circuit is to be deactivated.

- D. Controls manufacture shall perform field calibration tests based on test figures from manufacturer and shall confirm temperature readings are accurate based on current flow thru the over temperature sensor/switch provided with each pump. Pump manufacture is to provide certified calibration data for the current flow thru sensor over the range of pump operating temperatures.

2.38 TAGGING

- A. Provide Type 316 stainless steel tag on field-mounted units and permanently affix tag to unit.
- B. Include Engineer's tag number where listed in Control Diagrams.
- C. See Section 16195 – "Electrical Identification" for additional requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA "Standard of Installation," and recognized industry practices.
- B. Control Relay:
 - 1. Install panel control relays in I&C panel.
 - 2. Install motor starter control relays in MCC and wherever more rugged type relay required.

END OF SECTION

SECTION 16950
FIELD ELECTRONIC TRANSMITTERS

PART 1 GENERAL

1.00 CONDITIONS

- A. This copyright protected © specification is issued confidentially for this specific project only. Reproduction of this document for any other purpose is prohibited.
- B. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.
- C. Contractor shall contact local Factory Representative to verify all equipment purchased conforms to the requirements of this project. Failure to do so may result in equipment removal and replacement at Contractor’s expense. See Section 16012 – “Electrical Work,” Paragraph 1.04 – “Submittals” for submittal requirements.

1.01 SUMMARY

- A. Section Includes: Field transmitters for instrumentation and control (I&C) system and is applicable only where indicated on plans or other specification sections. Provide applicable transmitter type where indicated on plans.
- B. All readouts shall be in actual units measured for this specific project. Percent of scale readouts are not acceptable.

PART 2 PRODUCTS

2.01 ELECTRONIC GAUGE PRESSURE TRANSMITTER

- A. Manufacturers:
 - 1. Foxboro.
 - 2. Rosemount.
 - 3. Danfoss
 - 4. Or pre-approved equal.

- B. Electro-mechanical device to produce analog current signal as function of pressure input to it.
- C. Mounting: Universal bracket for 2-in. pipe mounting.
- D. Housing: Threaded, metal NEMA 4.
- E. Connections: 1/2 in. NTP.
- F. Wetted Parts: Type 316 stainless steel.
- G. Calibration Capability: Gauge, vacuum, and absolute.
- H. All readouts to be actual unit values and not percent scale.
- I. Output: 4-20 mA_{dc} into 400 ohms (24-vdc power) or 1,000 ohms (45-vdc power).
- J. Adjustments: Zero and span, for 5:1 rangeability.
- K. Power: 24 to 45 VDC.
- L. Accuracy: $\pm 0.5\%$ of span.
- M. Accessories:
 - 1. Weatherproof integral output indicator 0% to 100% linear.
 - 2. Zero elevation/suppression of at least 100% of span.
- N. Type: IGP 10
- O. Pressure Range: 0-150 psi (for water facility applications).

2.02 DIFFERENTIAL PRESSURE MONITORING DEVICE

- A. Manufacturers:
 - 1. Foxboro.
 - 2. Rosemount.
 - 3. Or pre-approved equal.
- B. Differential capacitance open loop principle device to produce analog current signal as function of differential pressure input to it.

- C. Mounting: 2-in. pipe mounting bracket.
- D. Housing: Threaded, metal NEMA 4.
- E. Wetted Parts: Type 316 stainless steel with 1/2 in. NPT connections.
- F. Output: 4-20 mA_{dc} into 400 ohms (24-vdc power) or 1,000 ohms (45-vdc power). Linear with input.
- G. Adjustments: Span with external zero.
- H. Power Required: 24 to 45 VDC.
- I. Accuracy: $\pm 0.5\%$ of span.
- J. Construction: Explosion-proof, FM approved for Class I, Division 1 service.
- K. Accessories:
 - 1. Type 316 stainless steel, 3-valve manifold to provide transmitter isolation and equalization.
 - 2. Weatherproof integral output indicator 0% to 100% linear.
- L. Provide integral square root extractor for differential pressure flow monitoring applications
- M. Provide diaphragm seal on transmitters at hydro tanks where corrosive chemicals are present or in water.
- N. Pressure Range: 0-150 psi (for water facility applications).

2.03 ELECTRONIC FLANGE MOUNTED LEVEL TRANSMITTER

- A. Manufacturers:
 - 1. Foxboro.
 - 2. Rosemount.
 - 3. Or pre-approved equal.
- B. Differential capacitance open loop principle device to produce analog current signal as function of liquid level input to it.

- C. Mounting: 150-lb flange mount.
- D. Housing: Threaded cover, metal, NEMA 4.
- E. Wetted Parts (Process Side): Flush mount, Type 316 stainless steel diaphragm.
- F. Water Span Adjustment: 20 to 200 in., 160 to 785 in. water.
- G. Provide elevation/suppression kit.
- H. Output: 4-20 mA_{dc} into 400 ohms (24-vdc power) or 1,000 ohms (45-vdc power).
- I. Adjustments: Zero, span, and dampening.
- J. Accuracy: $\pm 0.25\%$ of span.
- K. Construction: Explosion-proof, FM approved for Class I, Division 1 service (see specification for requirement).
- L. Accessories: Weatherproof integral output indicator scaled 0% to 100% linear, with input.

2.04 SUBMERSIBLE LEVEL TRANSMITTER

- A. Manufacturers:
 - 1. Blue Ribbon Model BC1000.
 - 2. Endress+Hauser
- B. Level transmitter consisting of variable capacitance, gauge pressure sensing assembly enclosed in submersible Type 316 stainless steel housing with Buna N pressure sensing diaphragm, special cable containing 1/8 in. breather tube and signal wiring, and sealed breather and transmitter assembly.
- C. Provide intrinsically safe barriers when used in hazardous areas.
- D. Transducer:
 - 1. Low movement 2-5/8 in. dia Buna N diaphragm.
 - 2. Hydraulic oil-filled.
 - 3. Nispan C pressure capsule.

4. Pressure exerted against diaphragm flexes minutely which varies proximity between internal ceramic diaphragm and ceramic substrate to vary capacitance of electrical field created between two surfaces.

E. Cable Assembly:

1. 1/2 in. outside dia.
2. Positive sealed where entering transducer housing.
3. Contains 1/8 in. breather tube.
4. Length: Approximately 50 ft.

F. Breather and Transmitter Assembly:

1. Solid state operational amplifier.
2. 2-wire, 4-20 mA_{dc} (power from controller).
3. Output loop resistance 0-1200 ohms.
4. Span and offset adjustable.
5. Fused.
6. Active transient protection.
7. Repeatability: $\pm 1/4$ of 1%.
8. Hysteresis: $\pm 0.15\%$ of element range.
9. Accuracy: $\pm 0.5\%$ of span.
10. Power: 110 vac.

2.05 RESISTANCE TO CURRENT TRANSMITTER

A. Manufacturers:

1. Foxboro.
2. Bristol.
3. Or pre-approved equal.

- B. Furnish solid-state device that will develop current analog signal from varying resistance input signal.
- C. Mounting: Wall or panel.
- D. Input Resistance: 0% output valve (40 to 470 ohms), output span valve (13 to 100 ohms).
- E. Output: 4-20 mAdc into 1,000 ohms.
- F. Adjustments: Span and bias.
- G. Accuracy: $\pm 0.5\%$ of span.
- H. Power: 120 vac, $\pm 10\%$, 60 Hz.

2.06 RESISTANCE BULB

- A. Nickel or platinum resistance bulb in sealed metal sleeve assembly complete with compression fitting and general-purpose weatherproof head.
- B. Connection: Union hub or separable well as shown on schedule.
- C. Resistance: Approximately 100 ohms.
- D. Length: As specified or required.

2.07 PROTECTING WELL

- A. Furnish threaded connection sleeve type device to protect temperature sensor from adverse pressure or corrosive conditions and enable sensor to be removed from service without shutting process down.
- B. Connection: 1/2 to 3/4 in. NPT.
- C. Length: As specified or required.
- D. Material: Type 316 stainless steel.

2.08 THERMOCOUPLE

- A. Type J or E, depending on service temperature range, insulated in Type 316 stainless steel metal sheath and spring loaded in Type 316 stainless steel separable well.
- B. Connection head assembly with 3/4 in. NPT conduit connection.

- C. Grounded measuring junction.
- D. Length: As required.

2.09 MILLIVOLT TO CURRENT TRANSMITTER

- A. Manufacturers:
 - 1. Rosemount.
 - 2. Foxboro.
 - 3. Or pre-approved equal.
- B. Solid state device that will develop current analog signal for varying thermocouple millivolt input signal.
- C. Mounting: Wall.
- D. Signal: Input: Thermocouple Type J or E; Output: 4-20 mAdc.
- E. Adjustments: Zero and span.
- F. Power: 2-wire, 24 VDC.
- G. Reference Junction Compensation: 32°F.
- H. Provide output indicator.

2.10 CAPACITANCE LEVEL MEASUREMENT SYSTEMS

- A. Manufacturers:
 - 1. Drexelbrook.
 - 2. Or pre-approved equal.
- B. System consists of level element, transmitter, and interconnecting cable.
- C. Element:
 - 1. Linear with level and made of flexible material.
 - 2. Approximately 1/16 in. thick by 3 in. wide.

3. Capable of ignoring coatings, inactive back to ignore moisture between element and vessel wall.
4. Design to slide in or out of mounting track provided. Fasten mounting track to vessel wall.
5. Provide mounting hardware (including ground reference probe).

D. Transmitter:

1. 4-wire transmitter.
2. 120 vac power.
3. 4-20 mA current signal proportional with level. (Provide 0 to 30-sec adjustable time delay on output.)
4. Weatherproof enclosure (NEMA 4/12).
5. Provide local indicator with linear graduations of 0 to 100.
6. Electrical Classification: General purpose.
7. Ambient Temperature Limits: 40°F to 160°F.
8. Design circuitry to ignore coatings on element.

E. Cable:

1. 3 conductors bonded to sensing element by waterproof potted head.
2. Cable Length: 25 ft (or longer, un-spliced).

2.11 CAPACITANCE FLOW MEASUREMENT SYSTEM

A. Manufacturers.

1. Drexelbrook.
2. Or pre-approved equal.

B. System consists of flow element, transmitter, and cable, to measure liquid head in approach section of rectangular weir.

C. Element:

1. Signal characterization to convert head measurement to flow rate shall be inherent to sensing element construction.
2. Approximately 1/16 in. thick by 3 in. wide.
3. Capable of ignoring coatings, inactive back to ignore moisture between element and vessel wall.
4. Design to slide in or out of mounting track provided. Supply lock-down bolt for stable vertical location.
5. Provide mounting hardware.

D. Transmitter:

1. 4-wire transmitter.
2. 120 vac power.
3. 4-20 mA current signal proportional to flow. (Provide 0 to 30 sec adjustable time delay on output.)
4. Weatherproof enclosure (NEMA 4/12).
5. Provide local indication with linear graduation 0 to 100.
6. Electrical Classification: General purpose.
7. Ambient Temperature: -40°F to 160°F.
8. Design circuitry to ignore coatings on element.

E. Cable:

1. 3 conductors bonded to sensing element by waterproof potted head.
2. Cable Length: 25 ft minimum (splicing not permitted).

2.12 ULTRASONIC LEVEL DETECTOR

A. Manufacturers:

1. Miltronics Ranger.
 2. Or pre-approved equal.
- B. Adjustable ultrasonic level system complete with electronics, cable and sensor.
- C. Level Switch Mounting: 2-in. NPT to 3-in. to 4-in. 125-lb PVC flange.
- D. Case: NEMA 4.
- E. Ultrasonic Frequency: 23 KHZ.
- F. Electronics: Solid state.
- G. Switch Output: One SPDT rated 3 amps at 115 vac, set for low-level shutdown.
- H. Level Range: 0 to 25 ft.
- I. Coaxial Cable: 50 ft minimum (splicing not permitted).
- J. Ambient Temperature: -30°F to 140°F. Provide with heated sensor and heated electronic case.
- K. Accuracy: $\pm 1\%$ of range.
- L. Power to Electronics Case: 120 vac.
- 2.13 SPECIAL PURPOSE PRESSURE TRANSMITTER
- A. For specific application where shown and described on plans.
- B. Manufacturers:
1. Danfoss – type MBS01250
 2. STAUFF – (equal to Danfoss)
 3. Or pre-approved equal.
- C. Electro-mechanical device to produce analog current signal as function of pressure input to it.
- D. Mounting: Universal bracket for pipe mounting. (See detail drawings)
- E. Housing: Threaded, metal NEMA 4.

- F. Connections: ½ in. NTP.
 - G. Wetted parts: Stainless steel.
 - H. Calibration Capability: Gauge.
 - I. All readouts to be actual unit values and not percent scale.
 - J. Output: 4-20 mA_{dc} into 400 ohms (24-vdc power).
 - K. Adjustments: Fixed.
 - L. Power: 24 VDC.
 - M. Accuracy: ±0.5% of span.
 - N. Accessories:
 - 1. Integral pulse snubber.
 - 2. MC protection up to 100v/m.
 - 3. Male connector with watertight rubber or polymer cap, 90 degree with ½ inch seal-tight connection.
 - O. Temperature: Up to 125 degrees C (257 degrees F).
 - P. Pressure Range: 0-150 psi (for water facility applications).
- 2.14 TAGGING
- A. Provide Type 316 stainless steel tag permanently affixed to unit (sensor and transmitter separately mounted).
 - B. Engrave with process application as listed in Specifications.
 - C. Include Engineer's tag number as listed in Specifications, P&ID's or, as shown on Plans.
 - D. See Section 16195 – “Electrical Identification” for additional requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's written instructions and approved submittals.
- B. Set-up and calibration of equipment shall only be performed by a Factory Technician.
- C. Provide diaphragm seal for all pressure transmitters that are used for measuring liquid level at hydro tanks and for all pressure transmitters measuring corrosive liquids or gasses. For high temperature air, gas or liquid measurements, install isolation diaphragm seal near pipe tap and provide extension piping to transmitter located remotely from heat source.
- D. For all differential level transmitters used to measure level of hydro tanks, provide a diaphragm seal at the top connection to the hydro tank to prevent water entry into the transmitter. Unit shall be rated for the pressure range of the transmitter and shall be stainless steel construction.

3.02 WARRANTY

- A. Contractor shall provide full 3-year service warranty on the overall installation, and shall include all labor and materials required to repair or replace equipment and/or components that are defective or malfunctioning. Included under this warranty shall be all equipment, devices, hardware, and software. This warranty shall begin on date of written "Final Acceptance" of the electrical systems and to be executed as required at no additional cost to the Owner. Contractor's warranty shall also guarantee 24-hour service response time and shall provide labor, work, or materials as necessary to maintain plant operation when replacement parts are on order. In no case shall plant electrical systems be out of service for more than 24 hours from time Owner calls for warranty service. This shall be provided at no additional cost to the Owner. All equipment and materials installed shall have full warranty from Manufacturer that guarantees equipment is rated for harsh industrial electrical/mechanical environment in which it is installed. Where Manufacturer's products fail prematurely, Manufacturer shall be fully responsible for new replacement and shall not have the option of declaring that failures were caused by environmental conditions and its affect on the product. Contractor is fully responsible for assuring that Product Manufacturers are aware of this condition and that warranty statement is included in shop drawing submittals. Failure to do so will be at the Contractor's expense and at no additional cost to the Owner.

- B. All critical warranted repairs shall be made within 24 hours of receipt of required parts from Manufacturer with reasonable delivery time of overnight shipping. Any repairs not completed within 5 working days from date of notice are subject to Owner making other arrangements for repair and back charging Contractor. This requirement is a condition of this contract.
- C. Where equipment or instrument problems remain unresolved by Contractor beyond a reasonable time, a Factory Technician shall be provided on-site to take any corrective actions necessary to put equipment or instruments in operating order. Owner and Engineer reserve the right to determine a reasonable time for corrective action by Contractor.
- D. Any failed equipment may not be repaired and returned to service prior to final acceptance. Only new equipment is allowed.
- E. For all differential level transmitters used to measure level of hydro tanks, provide a diaphragm seal at the connection to the hydro tank to prevent water entry into the transmitter. Unit shall be rated for the pressure range of the transmitter and shall be stainless steel construction.

3.03 CALIBRATION

- A. Provide services of a Factory Technician for calibration and programming of transmitters for range of variable with 4/20 mA representing 0 to 125 percent of maximum range. Allow for field adjustments during testing of installation.

END OF SECTION