



Advertise Date: Friday, March 17, 2017

Lee County Board of County Commissioners  
DIVISION OF PROCUREMENT MANAGEMENT

Invitation to Bid (B)  
Construction

Solicitation No.: **B170199DLK**

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Solicitation Name: **North Lee County Water Treatment Plant RO Concentrate Acid Feed System**

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Open Date/Time: **4/18/2017** Time: **2:30 PM**

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Location: Lee County Procurement Management  
1500 Monroe Street 4th Floor  
Fort Myers, FL 33901

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Procurement Contact: **Diana Khan** Title **Manager**

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Phone: **(239) 533-8881** Email: **[dkhan@leegov.com](mailto:dkhan@leegov.com)**

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Requesting Dept. **Utilities**

**Pre-Bid Conference:**

Type: **Mandatory**

Date/Time: **4/3/2017 9:00 AM**

Location: **North Lee County Water Treatment Plant: 18250 Durrance Road, Fort Myers, FL 33917**

All solicitation documents are available for download at  
[www.leegov.com/procurement](http://www.leegov.com/procurement)



**Notice to Bidder**

**Invitation to Bid #B170199DLK North Lee County Water Treatment Plant RO Concentrate Acid Feed System**

**Invitation to Bid (B) Construction**

Lee County, Fort Myers, Florida, is requesting bids from qualified individuals/firms for

**North Lee County Water Treatment Plant RO Concentrate Acid Feed System**

Then and there to be publicly opened and read aloud for the purpose of selecting a vendor to furnish all necessary labor, services, materials, equipment, tools, consumables, transportation, skills and incidentals required for Lee County, Fort Myers, Florida, in conformance with solicitation documents, which include technical specifications and/or a scope of work.

Those individuals/firms interested in being considered for this solicitation are instructed to submit, in accordance with specifications, their Bids, pertinent to this project prior to

**2:30 PM Tuesday, April 18, 2017**

to the office of the **Procurement Management, 1500 Monroe Street, 4<sup>th</sup> Floor, Fort Myers, Florida 33901**. The Invitation to Bid shall be received in a sealed envelope, prior to the time scheduled to receive Bid(s), and shall be clearly marked with the solicitation name, solicitation number, bidder name, and contact information as identified in these solicitation documents.

The Scope of Work/Specifications for this solicitation is available from [www.leegov.com/procurement](http://www.leegov.com/procurement). Bidders who obtain Scope of Work/Specifications from sources other than [www.leegov.com/procurement](http://www.leegov.com/procurement) are cautioned that the solicitation package may be incomplete. The County's official bidders list, addendum(s) and information must be obtained from [www.leegov.com/procurement](http://www.leegov.com/procurement). It is the bidder's responsibility to check for posted information. The County may not accept incomplete Bids.

**A MANDATORY Pre-Bid Conference has been scheduled for the following time and location:**

**9:00 AM April 3, 2017 North Lee County Water Treatment Plant, 18250 Durrance Road, Fort Myers, FL 33917** for the purpose of discussing the proposed project. Prospective bidders are encouraged to attend. All prospective bidders are encouraged to obtain and review plans, specifications, and scope of work for this bid before the pre-bid conference so that they may be prepared to discuss any question or concerns they have regarding this project. A site visit will follow the pre-bid conference. Questions regarding this solicitation are to be directed, in writing, to the individual listed below using the email address listed below or faxed to (239) 485 8383 during normal working hours.

**Diana Khan** [dkhan@leegov.com](mailto:dkhan@leegov.com)

Sincerely,

Mary G. Tucker, CPPO, FCCM, FCCN  
Procurement Management Director

\*[www.leegov.com/procurement](http://www.leegov.com/procurement) is the County's official posting site

**Terms and Conditions**  
**INVITATION TO BID (B)**  
**CONSTRUCTION**

1. DEFINITIONS

- 1.1. **Addendum/Addenda:** A written change, addition, alteration, correction or revision to a bid, proposal or contract Agreement/Contract. Addendum/Addenda may be issued following a pre-bid/pre-proposal conference or as a result of a specification or work scope change to the solicitation.
- 1.2. **Approved Alternate:** Solicitation documents may make reference of specific manufacturer(s) or product(s). These references serve only as a recommendation and a guide to minimum quality and performance. The references are not intended to exclude approved alternatives of other manufacturer(s) or product(s).
- 1.3. **Bid/Proposal Package:** A bid/proposal is a document submitted by a vendor in response to some type of solicitation to be used as a basis for negotiations or for entering into a contract.
- 1.4. **Bidder/Responder/Proposer:** One who submits a response to a solicitation.
- 1.5. **County:** Refers to Lee County Board of County Commissioners.
- 1.6. **Due Date and Time/Opening:** Is defined as the date and time upon which a bid or proposal shall be submitted to the Lee County Procurement Management Division. Only bids or proposals received prior to the established date and time will be considered.
- 1.7. **Liquidated Damages:** Damages paid usually in the form of monetary payment, agreed by the parties to a contract which are due and payable as damages by the party who breaches all or part of the contract. May be applied on a daily basis for as long as the breach is in effect.
- 1.8. **Procurement Management:** shall mean the Director of Lee County's Procurement Management Department or designee.
- 1.9. **Responsible:** A vendor, business entity or individual who is fully capable to meet all of the requirements of the bid/proposal solicitation documents and subsequent contract. Must possess the full capability including financial and technical, to perform as contractually required. Must be able to fully document the ability to provide good faith performance.
- 1.10. **Responsive:** A vendor, business entity or individual who has submitted a bid or request for proposal that fully conforms in all material respects to the bid/proposal solicitation documents and all of its requirements, including all form and substance.
- 1.11. **Solicitation:** An invitation to bid, a request for proposal, invitation to negotiate or any document used to obtain bids or proposals for the purpose of entering into a contract.

2. ORDER OF PRECEDENCE

- 2.1. In resolving conflicts, errors, and discrepancies, the order of precedence of the bid document is as follows
  - 2.1.1. Florida State Law as applied to Municipal Purchasing in accordance with Title XIX, "Public Business", Chapter 287 "Procurement of Personal Property and Services."
  - 2.1.2. Lee County Procurement Management Manual and Ordinances
  - 2.1.3. Change Order
  - 2.1.4. Agreement
  - 2.1.5. Addenda
  - 2.1.6. Special Conditions
  - 2.1.7. General Conditions, if any
  - 2.1.8. Specifications
  - 2.1.9. Supplemental Information
  - 2.1.10. Drawings/Plans, if any
  - 2.1.11. Figure Dimensions, if any
  - 2.1.12. Scale Dimensions (Large Scale Drawings supersede Small Scale Drawings)
  - 2.1.13. Terms and Conditions

### 3. RULES, REGULATIONS, LAWS, ORDINANCES AND LICENSES

- 3.1. It shall be the responsibility of the bidder to assure compliance with all other federal, state, or county codes, rules, regulations or other requirements, as each may apply. Any involvement with the Lee County shall be in accordance with but not limited to:
  - 3.1.1. Lee County Procurement Management Manual
  - 3.1.2. Pursuant to FL § Section 119.071, Public Records, General exemptions from inspection or copying of public records. Sealed bids, proposals or replies received by the agency pursuant to a solicitation are exempt from public records request (s. 119.07(1) and s. 24(a), Art. I, of the State Constitution until such time as the agency provides notice of an intended decision or until 30 days after opening the bids, proposals or final replies, whichever is earlier.
  - 3.1.3. FL § 215 regarding scrutinized companies and business operations.
  - 3.1.4. FL § 218 Public Bid Disclosure Act.
  - 3.1.5. Florida State Law as applied to Municipal Purchasing in accordance with Title XIX, “Public Business”, Chapter 287 “Procurement of Personal Property and Services.”
  - 3.1.6. FL § 337.168 Confidentiality of official estimates, identities of potential bidders, and bid analysis and monitoring system.
  - 3.1.7. FL § Section 607.1501(1) states: A foreign corporation may not transact business in the State of Florida until it obtains a certificate of authority from the Department of State.
- 3.2. **Local Business Tax Account:** As applicable, anyone providing merchandise or services to the public within the jurisdiction of Lee County must obtain a Lee County business tax account to operate unless specifically exempted.
- 3.3. **License(s):** Bidder should provide, at the time of the opening of the bid, licenses required for this product and/or service.

### 4. BID – PREPARATION OF SUBMITTAL

- 4.1. **Sealed Bid:** Submission must be in a sealed envelope/box, and the outside of the submission must be marked with the following information (Sealed Bid Label Form is attached for your use):
  - 4.1.1. Marked with the words “Sealed Bid”
  - 4.1.2. Bid Number
  - 4.1.3. Bid Title
  - 4.1.4. Bid Due Date
  - 4.1.5. Name of the firm submitting the bid
  - 4.1.6. Contact e-mail and telephone number
- 4.2. **Bid submission shall include:**
  - 4.2.1. Provide two (2) hard copies. Mark each: one “Original”, one “Copy”
  - 4.2.2. Provide one (1) electronic CD ROM or flash drive set of the entire submission documents.
  - 4.2.3. Electronic submission document is to be one single Adobe PDF file in the same order as the original hard copy.
  - 4.2.4. Limit the color and number of images to avoid unmanageable file sizes.
  - 4.2.5. Use rewritable CD ROM and do not lock files.
- 4.3. **Submission Format:**
  - 4.3.1. Required Forms: complete and return **all** required forms. If the form is not applicable please return with “Not Applicable” or “N/A” in large letters across the form.
  - 4.3.2. Failure to submit required or requested information may result in the bidder being found non-responsive.
  - 4.3.3. Execution of Bid: All documents must be properly signed by corporate authorized representative, witnessed, and where applicable corporate and/or notary seals affixed. All Bids shall be typed or printed in ink. The bidder may not use erasable ink. All corrections made to the bids shall be initialed.
  - 4.3.4. If a cost/bid schedule was provided in Microsoft Excel format, the returned completed schedule should be included as a Microsoft Excel File on the CD ROM or Flash drive.
  - 4.3.5. The submission should not contain links to other web pages.

- 4.3.6. Include any information requested by the County necessary to analyze your bid, i.e., required submittals, literature, technical data, financial statements.
- 4.3.7. Bid Security/Bond(s), as applicable (Construction projects)
- 4.4. **Preparation Cost:** The Bidder is solely responsible for any and all costs associated with responding to this solicitation. No reimbursement will be made for any costs associated with the preparation and submittal of any bid, or for any travel and per diem costs that are incurred by any Bidder.
5. **RESPONSES RECEIVED LATE**
- 5.1. It shall be the Bidder's sole responsibility to deliver the bid submission to the Lee County Procurement Management Division prior to or on the time and date stated. All references to date and time herein reference Lee County, FL local time.
- 5.2. Any bids received after the stated time and date will not be considered. The bid shall not be opened at the public opening. Arrangements may be made for the unopened bid to be returned at the bidder's request and expense.
- 5.3. The Lee County Procurement Management Division shall not be responsible for delays caused by the method of delivery such as, but not limited to; internet, United States Postal Service, overnight express mail service(s), or delays caused by any other occurrence.
6. **BIDDER REQUIREMENTS (unless otherwise noted)**
- 6.1. **Responsive and Responsible:** Only bids received from responsive and responsible bidders will be considered. The County reserves the right before recommending any award to inspect the facilities and organization; or to take any other necessary action, such as background checks, to determine ability to perform is satisfactory, and reserves the right to reject submission packages where evidence submitted or investigation and evaluation indicates an inability for the bidder to perform.
- 6.1.1. Bids may be declared "non-responsive" due to omissions of "Negligence or Breach of Contract" on the disclosure form. Additionally, bidders may be declared "not responsible" due to past or pending lawsuits that are relevant to the subject procurement such that they call into question the ability of the bidder to assure good faith performance. This determination may be made by the Procurement Management Director, after consulting with the County Attorney.
- 6.1.2. Additional sources may be utilized to determine credit worthiness and ability to perform.
- 6.1.3. Any bidder or sub-contractor that will have access to County facilities or property may be required to be screened to a level that may include, but is not limited to fingerprints, statewide criminal. There may be fees associated with these procedures. These costs are the responsibility of the bidder or sub-contractor.
- 6.2. **BID--Past Performance:** Bidders past performance and prior dealings with Lee County (i.e., failure to meet specifications, poor workmanship, late delivery, etc.) may be reviewed. Poor or unacceptable past performance may result in bidder disqualification.
- 6.3. Submission packages, unless otherwise noted, will be considered only from bidders normally engaged in the provision of the services specified here in. The bidder shall have adequate organization, facilities, equipment, and personnel to ensure prompt and efficient service to Lee County. The County reserves the right before recommending any award to inspect the facilities and organization; or to take any other action necessary to determine ability to perform satisfactory, and reserves the right to reject submission packages where evidence submitted or investigation and evaluation indicated an inability of the bidder to perform.
7. **PRE-BID CONFERENCE**
- 7.1. A pre-bid conference will be held in the location, date, and time specified on the cover of this solicitation. The cover will also note if the pre-bid conference is Non-Mandatory or Mandatory. All questions and answers are considered informal. All prospective bidders are encouraged to obtain and review the solicitation documents prior to the pre-bid conference so they may be prepared to discuss any questions or concerns they have concerning this project. All questions must be submitted formally in writing to the procurement staff noted on the first page of the bid document. A formal response will be provided in the form of an addendum (see "County Interpretation/Addendums" for additional information.) A site visit may follow the pre-bid conference, as applicable.

- 7.2. **Non-Mandatory:** Pre-bid conferences are generally non-mandatory, but it is highly recommended that prospective bidders participate.
- 7.3. **Mandatory:** Failure to attend a mandatory pre-bid conference will result in the bid being considered **non-responsive**.
8. COUNTY INTERPRETATION/ADDENDUMS
- 8.1. Each bidder shall examine the solicitation documents and shall judge all matters relating to the adequacy and accuracy of such documents. Any inquiries, suggestions or requests concerning interpretation, clarification or additional information pertaining to the bid shall be made **in writing, submitted at least eight (8) calendar days prior to the date when the bid is due**.
- 8.2. Response(s) will be in the form of an Addendum posted on [www.lee.gov/procurement](http://www.lee.gov/procurement). It is solely the bidder's responsibility to check the website for information. No notifications will be sent by Lee County Procurement Management Division.
- 8.3. All Addenda shall become part of the Contract Documents.
- 8.4. The County shall not be responsible for oral interpretations given by any County employee, representative, or others. Interpretation of the meaning of the plans, specifications or any other contract document, or for correction of any apparent ambiguity, inconsistency or error there in, shall be in writing. Issuance of a written addendum by the County's Procurement Management Division is the only official method whereby interpretation, clarification or additional information can be given.
9. QUALITY GUARANTEE/WARRANTY (as applicable)
- 9.1. Bidder will guarantee their work without disclaimers, unless otherwise specifically approved by the County, for a minimum of twelve (12) months from the date of final completion.
- 9.2. Unless otherwise specifically provided in the specifications, all equipment and materials and articles incorporated in the work covered by this contract shall be new, unused and of the most suitable grade for the purpose intended. Refurbished parts or equipment are not acceptable unless otherwise specified in the specifications. All warranties will begin from the date of final completion.
- 9.3. Unless otherwise specifically provided in the specifications, the equipment must be warranted for twelve (12) months, shipping, parts and labor. Should the equipment be taken out of service for more than forty-eight (48) hours to have warranty work performed, a loaner machine of equal capability or better shall be provided for use until the repaired equipment is returned to service at no additional charge to the County.
- 9.4. If any product does not meet performance representation or other quality assurance representations as published by manufacturers, producers or distributors of such products or the specifications listed, the vendor shall pick up the product from the County at no expense to the County. The County reserves the right to reject any or all materials, if in its judgment the item reflects unsatisfactory workmanship or manufacturing or shipping damage. The vendor shall refund, to the County, any money which has been paid for same.
10. SUBSTITUTION(S)/APPROVED ALTERNATE(S)
- 10.1. Unless otherwise specifically provided in the specifications, reference to any equipment, material, article or patented process, by trade name, brand name, make or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. If a bidder wishes to make a substitution in the specifications, the bidder shall furnish to the County, **no later than ten (10) business days prior to the bid opening date**, the name of the manufacturer, the model number, and other identifying data and information necessary to aid the County in evaluating the substitution. Such information is submitted through the Procurement Management Division. Any such substitution shall be subject to County approval through the issuance of a written addendum by the County's Procurement Management Division. Substitutions shall be approved only if determined by the County to be an **Approved Alternate** to the prescribed specifications.
- 10.2. A bid containing a substitution is subject to disqualification if the substitution is not approved by the County. Items bid must be identified by brand name, number, manufacturer and model, and shall include full descriptive information, brochures, and appropriate attachments. Brand names are used for descriptive purposes only. An **Approved Alternate** product or service may be used.



## 11. NEGOTIATED ITEMS

- 11.1. Any item not outlined in the Scope of Work/Specifications may be subject to negotiations between the County and the successful bidder.
- 11.2. After award of this bid the County reserves the right to add or delete items/services at prices to be negotiated at the time of addition or deletion.
- 11.3. At contract renewal time(s) or in the event of significant industry wide market changes, the County may negotiate justified adjustments such as price, terms, etc., if in its sole judgment, the County considers such adjustments to be in their best interest.

## 12. ERRORS, OMISSIONS, CALCULATION ERRORS (as applicable)

- 12.1. **Calculation Errors:** In the event of multiplication/addition error(s), the unit price shall prevail. Written prices shall prevail over figures where applicable. All bids will be reviewed mathematically and corrected, if necessary, using these standards, prior to further evaluation.

## 13. CONFIDENTIALITY

- 13.1. Bidders should be aware that all submissions provided are subject to public disclosure and will **not** be afforded confidentiality, unless provided by Chapter 119 FL §.
- 13.2. If information is submitted with a bid that is deemed “Confidential” the bidder must stamp those pages of the submission that are considered confidential. The bidder must provide documentation as to validate why these documents should be declared confidential in accordance with Chapter 119, “Public Records,” exemptions.
- 13.3. Lee County **will not reveal engineering estimates or budget amounts for a project** unless required by grant funding or unless it is in the best interest of the County. According to FL § 337.168: A document or electronic file revealing the official cost estimate of the department of a project is confidential and exempt from the provisions of s. 119.07(1) until the contract for the project has been executed or until the project is no longer under active consideration.

## 14. BID -- CONFLICT OF INTEREST

- 14.1. **Business Relationship Disclosure Requirement:** The award hereunder is subject to the provisions of Chapter 112, Public Officers and Employees: General Provisions, Florida Statutes. All bidders must disclose with their submission the name of any officer, director or agent who is also an employee of the Lee County or any of its agencies. Further, all bidders must disclose the name of any County employee who owns directly or indirectly, an interest of five percent (5%) or more in the bidder’s firm or any of its branches.

## 15. ANTI-LOBBYING CLAUSE (Cone of Silence)

- 15.1. Following FL § Section 287.057(23), Upon the issuance of the solicitation, prospective proposers/bidders or any agent, representative or person acting at the request of such proposer/bidder shall not have any contact, communicate with or discuss any matter relating in any way to the solicitation with any Commissioner, Evaluation Review Committee, agent or employee of the County other than the Procurement Management Director or their designee. This prohibition begins with the issuance of any solicitation, and ends upon execution of the final contract or when the solicitation has been cancelled. **If it is determined that improper communications were conducted, the Bidder/Proposer may be declared non-responsible.**

## 16. DRUG FREE WORKPLACE

- 16.1. Lee County Board of County Commissioners encourages Drug Free Workplace programs as defined in accordance with Section 287.087, FL §.

## 17. DISADVANTAGED BUSINESS ENTERPRISE (DBE)

- 17.1. The County encourages the use of Disadvantaged Business Enterprise Bidder(s) as defined and certified by the State of Florida Department of Transportation (DBE).

- 17.2. As requested in the required forms the Bidder is required to indicate whether they and/or any proposed sub-contractor(s) are Disadvantaged Business Enterprises (DBE). Lee County encourages the utilization and participation of DBEs in procurements, and evaluation proceedings will be conducted within the established guidelines regarding equal employment opportunity and nondiscriminatory action based upon the grounds of race, color, sex or national origin. Interested certified Disadvantaged Business Enterprise (DBE) firms as well as other minority-owned and women-owned firms, as defined and certified by the State of Florida Office of Supplier Diversity (Minority), are encouraged to respond.

#### 18. ANTI-DISCRIMINATION/EQUAL EMPLOYMENT OPPORTUNITY

- 18.1. The bidder agrees to comply, in accordance with FL § 287.134, 504 of the Rehabilitation Act of 1973 as amended, the Americans with Disabilities Act of 1990 (ADA), the ADA Amendments Act of 2008 (ADAAA) that furnishing goods or services to the County hereunder, no person on the grounds of race, religion, color, age, sex, national origin, disability or marital status shall be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination.
- 18.2. The bidder will not discriminate against any employee or applicant for employment because of race, religion, color, age, sex, national origin, disability or marital status. The bidder will make affirmative efforts to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, age, sex, national origin, disability or marital status.
- 18.3. The bidder will include the provisions of this section in every sub-contract under this contract to ensure its provisions will be binding upon each sub-contractor. The bidder will take such actions in respect to any sub-contractor, as the contracting agency may direct, as a means of enforcing such provisions, including sanctions for non-compliance.
- 18.4. An entity or affiliate who has been placed on the State of Florida's Discriminatory Vendor List (This list may be viewed by going to the Department of Management Services website at <http://www.dms.myflorida.com>) may not submit a bid on a contract to provide goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not award or perform work as a vendor, supplier, sub-contractor, or consultant under contract with any public entity, and may not transact business with any public entity.

#### 19. LOCAL BIDDER'S PREFERENCE

- 19.1. The Lee County Local Bidder's Preference Ordinance No. 08-26 is being included as part of the award process for this project. As such, Lee County at its sole discretion may chose to award a preference to any qualified "Local Contractor/Vendor" in an amount not to exceed 3% of the total amount quoted by that firm.
- 19.2. "Local Contractor/Vendor" as noted in Ordinance No. 08-26, or revision thereof, shall be defined as:
- 19.2.1. Any person, firm, partnership, company or corporation whose principal place of business in the sole opinion of the County, is located within the boundaries of Lee/Collier County, Florida
- OR
- 19.2.2. Any person, firm, partnership, company or corporation that has provided goods or services to Lee County on a regular basis for the preceding consecutive three (3) years, and that has the personnel, equipment and materials located within the boundaries of Lee/Collier County sufficient to constitute a present ability to perform the service or provide the goods.

#### 20. SUB-CONTRACTOR

- 20.1. The use of sub-contractors under this solicitation requires prior written authorization from the County representative.

#### 21. BID - PROJECT GUIDELINES (as applicable)

- 21.1. The County has established the following Guidelines, Criteria, Goals, Objectives, Constraints, Schedule, Budget and or Requirements which shall service as a guide to the bidder(s) in conforming to the provision of goods and/or services to be provided pursuant to this Agreement/Contract:
- 21.1.1. No amount of work is guaranteed upon the execution of an Agreement/Contract.



- 21.1.2. Rates and all other negotiated expenses will remain in effect throughout the duration of the Agreement/Contract period.
- 21.1.3. This contract does not entitle any bidder to exclusive rights to County Agreement/Contracts/contracts. The County reserves the right to perform any and all available required work in-house or by any other means it so desires.
- 21.1.4. In reference to vehicle travel, mileage and man-hours spent in travel time, is considered incidental to the work and not an extra compensable expense.
- 21.1.5. Lee County reserves the right to add or delete, at any time, and or all material, tasks or services associated with this Agreement/Contract.
- 21.1.6. Any Single Large Project: The County, in its sole discretion, reserves the right to separately solicit any project that is outside the scope of this solicitation, whether through size, complexity or the dollar value.

## 22. BID – TIEBREAKER

- 22.1. Whenever two or more bids, which are equal with respect to price, quality and service, are received for procurement of commodities or contractual services, from responsive and responsible bidders the following steps will be taken to establish the award to the lowest bidder. This method shall be used for all ties.
  - 22.1.1. Step 1 Local Bidder: Between a local business, and a non-local business, a contract award, or the first opportunity to negotiate, as applicable, shall be made to the local business. Local shall be defined by Lee County Ordinance 08-26 or current revision thereof.
  - 22.1.2. Step 2 Drug Free Workplace: At the conclusion of step 1 if all is equal, the vendor with a Drug Free Workplace program shall be given preference, over a vendor with no Drug Free Workplace program. The contract award, or the first opportunity to negotiate, as applicable, shall be made to the bidder with the Drug Free Workplace program. In order to have a drug free workplace program, a business shall comply with the requirements of FL § 287.087.
  - 22.1.3. Step 3 Coin Flip: At the conclusion of Step 1, and Step 2 if all is equal, the contract award, or the first opportunity to negotiate, as applicable, shall be determined by the flip of a coin to determine final outcome.
- 22.2. When the tie has been determined the contract award, or the first opportunity to negotiate, as applicable, shall be made.
- 22.3. If an award or negotiation is unsuccessful with the initial bidder, award or negotiations may commence with the next highest bidder, utilizing the tiebreaker steps above to make the determination of next lowest bidder.

## 23. WITHDRAWAL OF BID

- 23.1. No bid may be withdrawn for a period of **180 calendar days** after the scheduled time for receiving submissions. A bid may be withdrawn prior to the solicitation opening date and time. Withdrawal requests must be made in writing to the Procurement Management Director, who will approve or disapprove the request.
- 23.2. A bidder may withdraw a submission any time prior to the opening of the solicitation.
- 23.3. After submissions are opened, but prior to award of the contract by the County Commission, the Procurement Management Director may allow the withdrawal of a bid because of the mistake of the bidder in the preparation of the submission document. In such circumstance, the decision of the Procurement Management Director to allow the submission withdrawal, although discretionary, shall be based upon a finding that the bidder, by clear and convincing evidence, has met each of the following four tests:
  - 23.3.1. The bidder acted in good faith in submitting the bid,
  - 23.3.2. The mistake in bid preparation that was of such magnitude that to enforce compliance by the bidder would cause a severe hardship on the bidder,
  - 23.3.3. The mistake was not the result of gross negligence or willful inattention by the bidder; and
  - 23.3.4. The mistake was discovered and was communicated to the County prior to the County Commission having formally awarded the Agreement/Contract.

## 24. PROTEST RIGHTS

- 24.1. Any bidder that has submitted a formal response to Lee County, and who is adversely affected by an intended decision with respect to the award, has the right to protest an intended decision posted by the County as part of the solicitation process.
- 24.2. “Decisions” are posted on the Lee County Procurement Management Division website. Bidders are solely responsible to check for information regarding the solicitation. ([www.leegov.com/procurement](http://www.leegov.com/procurement))
- 24.3. Refer to the “Bid/Proposal Protest Procedure” section of the Lee County “Contracts Manual” for the complete protest process and requirements. The Manual is posted on the Lee County website or may be obtained by contacting the Procurement Management Director.
- 24.4. In order to preserve the right to protest, a written “**Notice Of Intent To File A Protest**” **must be filed with the Lee County Procurement Management Director by 4:00 PM on the 3<sup>rd</sup> working day after the decision** affecting your rights is posted on the Lee County website.
- 24.4.1. The notice must clearly state the basis and reasons for the protest.
- 24.4.2. The notice must be physically received by the Procurement Management Director within the required time frame. No additional time will be granted for mailing.
- 24.5. To secure the right to protest a “**Protest Bond**” and written “**Formal Protest**” document must be filed **within 10 calendar days** after the date of “*Notice of Intent to File a Protest*” is received by the Procurement Management Director.
- 24.6. **Failure to follow the protest procedures requirement within the time frames as prescribed herein and established by the Lee County Board of County Commissioners, Florida, shall constitute a waiver of the right to protest and bar any resulting claims.**
25. AUTHORITY TO UTILIZE BY OTHER GOVERNMENT ENTITIES
- 25.1. This opportunity is also made available to any government entity. Pursuant to their own governing laws, and subject to the Agreement/Contract of the vendor, other entities may be permitted to make purchases at the terms and conditions contained herein. Lee County Board of County Commissioners will not be financially responsible for the purchases of other entities from this solicitation.
26. CONTRACT ADMINISTRATION
- 26.1. **Designated Contact:**
- 26.1.1. The awarded bidder shall appoint a person(s) to act as a primary contact for all County departments. This person or back-up shall be readily available during normal working hours by phone or in person, and shall be knowledgeable of the terms and procedures involved.
- 26.1.2. Lee County requires that the awarded bidder provide the name of a contact person(s) and phone number(s) which will afford Lee County access 24 hours per day, 365 days per year, of this service in the event of major breakdowns or natural disasters.
- 26.2. **BID – Term:** (unless otherwise stated in the Scope of Work or Detailed Specifications)
- 26.2.1. Unless otherwise stated in the scope of work, specifications, or special conditions the default **contract term shall be one (1) year with three (3), one (1) year renewals for a total of four (4) years upon mutual Agreement/Contract of both parties.**
- 26.2.2. The County reserves the right to renew this Agreement/Contract (or any portion thereof) and to negotiate pricing as a condition for each.
- 26.2.3. The County’s performance and obligation to pay under this contract, and any applicable renewal options, is contingent upon annual appropriation of funds.
- 26.3. **BID – Basis of Award:**
- 26.3.1. The bid is awarded under a system of sealed, competitive bidding to the lowest responsive and responsible bidder.
- 26.3.2. In the event the lowest responsive and responsible bid for a project exceeds the available funds the County may negotiate an adjustment of the bid price with the lowest responsive and responsible bidder, in order to bring the total cost of the project within the amount of available funds.
- 26.3.3. The County reserves the right to make award(s) by individual item, group of items, all or none, or a combination thereof. The County reserves the right to reject any and all bids or to waive any minor

irregularity or technicality in the bids received. Award will be made to the lowest responsible and responsive bidder(s) within the category chosen for basis of award.

26.3.4. The County reserves the right to award to one or multiple bidders at the discretion of the requesting authority and approval of the Procurement Management Director.

26.4. **Agreement/Contracts/Contracts:**

26.4.1. The awarded bidder will be required to execute an Agreement/Contract as a condition of award. A sample of this document may be viewed on-line at <http://www.leegov.com/procurement/forms>.

26.5. **Records:**

26.5.1. **Retention:** The bidder shall maintain such financial records and other records as may be prescribed by Lee County or by applicable federal and state laws, rules and regulations. Unless otherwise stated in the specifications, the bidder shall retain these records for a period of five years after final payment, or until they are audited by Lee County, whichever event occurs first.

26.5.2. **Right to Audit/Disclosure:** These records shall be made available during the term of the contract as well as the retention period. These records shall be made readily available to County personnel with reasonable notice and other persons in accordance with the Florida General Records Schedule. Awarded Bidder/Proposer(s) are hereby informed of their requirement to comply with FL §119 specifically to:

26.5.2.1. Keep and maintain public records required by the County to perform the service.

26.5.2.2. Upon request from the County's custodian of public records, provide the County with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided or as otherwise provided by law.

26.5.2.3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the contractor does not transfer the records to the County.

26.5.2.4. Upon completion of the contract, transfer, at no cost, to the County all public records in possession of the contractor or keep and maintain public records required by the County to perform the service. If the contractor transfers all public records to the County upon completion of the contract, the contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the County, upon request from the County's custodian of public records, in a format that is compatible with the information technology systems of the County.

26.5.3. **Public Record: IF THE VENDOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE VENDOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THE CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT 239-533-2221, 2115 SECOND STREET, FORT MYERS, FL 33901, <http://www.leegov.com/publicrecords>.**

26.5.4. **Ownership:** It is understood and agreed that all documents, including detailed reports, plans, original tracings, specifications and all data prepared or obtained by the successful bidder in connection with its services hereunder, include any documents bearing the professional seal of the successful bidder, and shall be delivered to and become the property of Lee County, prior to final payment to the successful bidder or the termination of the Agreement/Contract. This includes any electronic versions, such as CAD or other computer aided drafting programs.

26.6. **Termination:**

26.6.1. Any Agreement/Contract as a result of this solicitation may be terminated by either party giving **thirty (30) calendar days advance written notice**. The County reserves the right to accept or not

accept a termination notice submitted by the vendor, and no such termination notice submitted by the vendor shall become effective unless and until the vendor is notified in writing by the County of its acceptance.

- 26.6.2. The Procurement Management Director may immediately terminate any Agreement/Contract as a result of this solicitation for emergency purposes, as defined by the Lee County Purchasing and Payment Procedures Manual (Purchasing Manual), (also known as Appendix "D" "AC-4-1.pdf".)
- 26.6.3. Any bidder who has voluntarily withdrawn from a solicitation without the County's mutual consent during the contract period shall be barred from further County procurement for a **period of 180 days**. The vendor may apply to the Board for a waiver of this debarment. Such application for waiver of debarment must be coordinated with and processed by the Procurement Management Department.
- 26.6.4. The County reserves the right to terminate award or contract following any of the below for goods or services over \$1,000,000:
  - 26.6.4.1. Contractor is found to have submitted a false certification as provided under FL § 287.135 (5);
  - 26.6.4.2. Contractor has been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List (FL §215.473);
  - 26.6.4.3. Contractor has engaged in business operations in Cuba or Syria (FL § 215.471);
  - 26.6.4.4. Contractor has been placed on the Scrutinized Companies that Boycott Israel List, or is engaged in a boycott of Israel. (FL § 215.4725)
  - 26.6.4.5. The County reserves the right to review, on a case-by-case basis, and waive this stipulation if it is deemed to advantageous to the County.

## 27. WAIVER OF CLAIMS

- 27.1. Once this contract expires, or final payment has been requested and made, the awarded bidder shall have waived any claims against the County concerning this contract. After that period, the County will consider the bidder to have waived any right to claims against the County concerning this Agreement/Contract.

## 28. LEE COUNTY PAYMENT PROCEDURES

- 28.1. Unless otherwise noted, all vendors are requested to mail an original invoice to:  
**Lee County Finance Department**  
**Post Office Box 2238**  
**Fort Myers, FL 33902-2238**
- 28.2. All invoices will be paid as directed by the Lee County payment procedure unless otherwise stated in the detailed specifications for this project.
- 28.3. Lee County will not be liable for requests for payment deriving from aid, assistance, or help by any individual, vendor, proposer, or bidder for the preparation of these specifications.
- 28.4. Lee County is generally a tax exempt entity subject to the provisions of the 1987 legislation regarding sales tax on services. Lee County will pay those taxes for which it is obligated, or it will provide a Certificate of Exemption furnished by the Department of Revenue. All bidders should include in their bids, all sales or use taxes, which they will pay when making purchases of material or sub-contractor's services.

## 29. MATERIAL SAFETY DATA SHEETS (MSDS) (as applicable)

- 29.1. In accordance with Chapter 443 of the FL §, it is the vendor's responsibility to provide Lee County with Material Safety Data Sheets on bid materials, as may apply to this procurement.

## 30. DEBRIS DISPOSAL (as applicable)

- 30.1. Unless otherwise stated, the bidder shall be fully responsible for the lawful removal and disposal of any materials, debris, garbage, vehicles or other such items which would interfere with the undertaking and completion of the project. There shall not be an increase in time or price associated with such removal.

## 31. SHIPPING (as applicable)

- 31.1. Cost of all shipping to the site, including any inside delivery charges and all unusual storage requirements shall be borne by the bidder unless otherwise agreed upon in writing prior to service. It shall be the bidders responsibility to make appropriate arrangements, and to coordinate with authorized personnel at the site, for proper acceptance, handling, protection and storage (if available) of equipment and material delivered. All pricing to be F.O.B. destination.
- 31.2. The materials and/or services delivered under the bid shall remain the property of the seller until a physical inspection and actual usage of these materials and/or services is accepted by the County and is deemed to be in compliance with the terms herein, fully in accord with the specifications and of the highest quality.

## 32. BOND/SURETY (CONSTRUCTION)

- 32.1. Bonding/Surety is required for construction projects over \$100,000.00 unless otherwise noted.
- 32.2. **Bid Bond/Security:** The bidder/vendor shall submit **not less than 5% of proposed dollar amount** (including applicable alternates) as bid security. One **ORIGINAL** Bid Bond/Security is to be submitted to the County with Bid Submission. The Bid Security of the bidder/vendor will be retained until the bidder/vendor has executed the contract, whereupon the Bid security may be returned. The bid Security of the bidder/vendor whom the County believes to have a reasonable chance of receiving the award may be retained by the County until the effective date of the Agreement/Contract, whereupon Bid Securities furnished by the bidder/vendor may be returned. The following types of Bid Security are acceptable:
- 32.2.1. **A Certified Check or a Cashier's Check** in the stated dollar amount of not less than 5% of proposed dollar amount. Any Certified Check or Cashier Check submitted in lieu of a Bid Bond Shall be drawn on a solvent bank or trust company, made payable to Lee County Board of County Commissioners and shall have all necessary documentary revenue stamps attached (if required by law); or
- 32.2.2. **A Bid Bond** may be submitted on a Lee County paper Bid Bond Form. Must be signed by all required parties, of not less than 5% of proposed dollar amount (including Alternate(s) as applicable) shall accompany each submission. The Bid Bond shall be issued by a duly authorized surety authorized to do business and in good standing with the Florida Department of state.
- 32.3. **Payment and Performance Bond:** In accordance with F.S. 255.05 and Lee County Ordinance 95-2-102, a Public Payment and Performance Bond is to be issued in a sum equal to one-hundred (100%) percent of the total awarded contract amount by a surety company considered satisfactory by Lee County and otherwise authorized to transact business in the State of Florida shall be required from the successful bidder/vendor. This shall insure the faithful performance of the obligations imposed by the resulting contract and protect the County from lawsuits for non-payment of debts incurred during the successful bidder/vendor performance under such Contract.
- 32.3.1. A public Payment and Performance bond must be properly executed, by the Surety Company and successful bidder/vendor, and recorded with the Lee County Clerk of Court, within **seven calendar days** after notification by Lee County of the approval to award the Contract.
- 32.3.2. **A Clean Irrevocable Letter of Credit or Cash Bond** may be accepted by the County in lieu of the Public Payment and Performance Bond.
- 32.4. Only Lee County form(s) may be accepted. Forms are available at <https://www.leegov.com/procurement/forms>.
- 32.5. **Personal Checks are not acceptable to Lee County as a Bid Security.**
- 32.6. **Surety:** In order to be acceptable to the County, a Surety Company issuing Evidence of Bondability, Bid Guaranty Bonds or 100% Public Payment and Performance Bonds or Letters of Credit called for herein shall meet and comply with the minimum standards set forth in as part of the Contract Documents. The surety company shall be authorized to do business and in good standing with the Florida Department of State. All such bonds shall be issued or countersigned by a local producing agent who is a Florida resident with satisfactory evidence of its authority to execute the bond being submitted.

## 33. INSURANCE (AS APPLICABLE)

- 33.1. Insurance shall be provided by the awarded bidder/vendor. Prior to execution of the Agreement/Contract a certificate of insurance (COI) complying with the bid documents shall be provided by the bidder/vendor.

## End of Terms and Conditions Section



## Major Insurance Requirements

**Minimum Insurance Requirements:** *Risk Management in no way represents that the insurance required is sufficient or adequate to protect the vendors' interest or liabilities. The following are the required minimums the vendor must maintain throughout the duration of this contract. The County reserves the right to request additional documentation regarding insurance provided*

- a. **Commercial General Liability** - Coverage shall apply to premises and/or operations, products and completed operations, independent contractors, contractual liability exposures with minimum limits of:

\$1,000,000 per occurrence  
 \$2,000,000 general aggregate  
 \$1,000,000 products and completed operations  
 \$1,000,000 personal and advertising injury

- b. **Business Auto Liability** - The following Automobile Liability will be required and coverage shall apply to all owned, hired and non-owned vehicles use with minimum limits of:

\$1,000,000 combined single limit (CSL)  
 \$500,000 bodily injury per person  
 \$1,000,000 bodily injury per accident  
 \$500,000 property damage per accident

- c. **Workers' Compensation** - Statutory benefits as defined by FS 440 encompassing all operations contemplated by this contract or agreement to apply to all owners, officers, and employees regardless of the number of employees. Workers Compensation exemptions may be accepted with written proof of the State of Florida's approval of such exemption. Employers' liability will have minimum limits of:

\$500,000 per accident  
 \$500,000 disease limit  
 \$500,000 disease – policy limit

\*The required minimum limit of liability shown in a and b may be provided in the form of "Excess Insurance" or "Commercial Umbrella Policies." In which case, a "Following Form Endorsement" will be required on the "Excess Insurance Policy" or "Commercial Umbrella Policy."

**Verification of Coverage:**

1. Coverage shall be in place prior to the commencement of any work and throughout the duration of the contract. A certificate of insurance will be provided to the Risk Manager for review and approval. The certificate shall provide for the following:

a. The certificate holder shall read as follows:

Lee County Board of County Commissioners  
P.O. Box 398  
Fort Myers, Florida 33902

b. *“Lee County, a political subdivision and Charter County of the State of Florida, its agents, employees, and public officials”* will be named as an "Additional Insured" on the General Liability policy, including Products and Completed Operations coverage.

**Special Requirements:**

1. An appropriate "Indemnification" clause shall be made a provision of the contract.
2. It is the responsibility of the general contractor to insure that all subcontractors comply with all insurance requirements.

End of Insurance Guide Section

## **SPECIAL CONDITIONS**

These are conditions that are in relation to this solicitation only and have not been included in the County's standard Terms and Conditions or the Scope of Work.

### **1. Scope of Work**

This project consists of replacement of portions of an existing sulfuric acid pumping system and repurposing the system for injection of acid into the North Lee County WTP reverse osmosis (RO) concentrate waste stream.

### **2. Basis of Award**

Award will be made to the lowest most responsive, responsible, and qualified bidder meeting all requirements of this solicitation. The County reserves the right to award to the Contractor whose prices, in its sole judgment, are the most realistic in terms of provision of the best services and in the best interest of the County. The County reserves the right to reject any and all bids at any time, unconditionally, and without cause.

### **3. Term**

From the Notice to Proceed or the Purchase Order date, whichever applies: **120** calendar days to substantial completion, **40** calendar days to final completion (total days**160**)

### **4. Liquidated Damages**

In accordance with the terms set forth in the Agreement, for each consecutive calendar day of delay in achieving Substantial Completion as set forth herein, the Contractor shall be liable to the County for per diem liquidated damages in the amount of \$760.00

### **5. Minimum Requirements/Related Project Experience**

Three (3) projects performed in the last five (5) years that included installation of chemical feed system(s) for water treatment in an operational water treatment facility.

### **6. Bidder/Sub-Contractor Relationship**

The prime bidder/contractor on a project may not also be listed as a sub-contractor to another firm submitting a bid for the same solicitation. Should this occur, all responses from the involved/named firms will be considered non-compliant and rejected for award. Sub-contractors may be listed on multiple submissions for the same solicitation.

End of Special Conditions Section

## GENERAL CONDITIONS

### 1. Administration

The Consultant is the initial interpreter of the Contract Documents but is not the Judge between the COUNTY and the CONTRACTOR. The COUNTY reserves the right to make final decisions considering the Consultant's recommendations or interpretations of the Contract Documents. The Consultant does not have authority to obligate or commit the COUNTY to fund additional expenditures or approve extensions of time over the approved Contract time or price. However, the CONSULTANT'S interpretation as to the intent of his design shall be final and not subject to interpretation by the COUNTY'S staff.

#### 1.1. Copies of Documents

The COUNTY shall furnish to the CONTRACTOR the number of copies specified in the Supplemental Information of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction which shall be paid by the CONTRACTOR.

#### 1.2. Before Starting Construction

Before undertaking each phase of the Work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. The CONTRACTOR shall promptly report in writing to the OWNER'S REPRESENTATIVE any conflict, error or discrepancy which the CONTRACTOR may discover or other information known to the CONTRACTOR and shall obtain a written interpretation or clarification from the OWNER'S REPRESENTATIVE before proceeding with any Work affected thereby. If the CONTRACTOR performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the OWNER'S REPRESENTATIVE, the CONTRACTOR shall assume responsibility for such performance and shall share in costs associated with correction; however, the CONTRACTOR shall not be liable to the COUNTY for failure to report any conflict, error or discrepancy in the Contract Documents, unless the CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

1.2.1. Within ten calendar days after the Effective Date of the Agreement (unless otherwise specified in the Contract Documents), the CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE for review:

- 1.2.1.1. An estimated progress schedule indicating the starting and completion dates of the various stages of the Work:
- 1.2.1.2. Long lead item shall be identified and scheduled accordingly.
- 1.2.1.3. A preliminary schedule of Shop Drawing submission; and
- 1.2.1.4. A preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction on form No. CMO:013. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by the CONTRACTOR at the time of submission; and specify times for Application for Payment.
- 1.2.1.5. A plan of work for maintenance of traffic, when the Contract Documents require maintenance of traffic.
- 1.2.1.6. For informational purposes, a proposed listing of sub-contractors to be used for the project.

### 1.2.2. **Pre-Construction Conference**

Within fifteen calendar days after the Effective Date of the Agreement, but before the CONTRACTOR starts the Work at the site, a conference attended by the CONTRACTOR, the OWNER'S REPRESENTATIVE, the COUNTY, and Others as appropriate, will be held to discuss the items, to discuss procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish an understanding among the parties as to the Work.

### 1.2.3 **Finalizing Schedules**

At least ten calendar days before submission of the first Application for payment, a conference attended by the CONTRACTOR, the OWNER'S REPRESENTATIVE, the COUNTY, and Others as appropriate, will be held to finalize the schedules submitted. The finalized progress schedule will be acceptable to the OWNER'S REPRESENTATIVE and the COUNTY as providing an orderly progression of the Work to completion within the Contract Time, but such acceptance will neither impose on the OWNER'S REPRESENTATIVE or the COUNTY responsibility for the progress or scheduling of the Work nor relieve the CONTRACTOR from full responsibility therefor. The finalized schedule of Shop Drawing submissions will be acceptable to the OWNER'S REPRESENTATIVE as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to the OWNER'S REPRESENTATIVE and the COUNTY as to form and substance.

## **Definitions**

The following definition of terms associated with this Contract is provided to establish a common understanding between both parties to this Contract as to the intended usage, application and interpretation of such terms pertaining to this Contract.

*ADDENDUM* means any additional Contract provisions in writing signed and sealed by the CONSULTANT, if applicable, issued by the COUNTY prior to the receipt of Bid which clarify, correct, change or interpret the Bidding Documents or the Contract Documents.

*AGREEMENT* means the written agreement between the COUNTY and the CONTRACTOR covering the Work to be performed; the Agreement is a part of the Contract Documents.

*BIDDER* is any individual, firm, partnership, joint venture, or corporation submitting a bid for this project, acting directly or through an authorized representative.

*BID* is a complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein, submitted in accordance with the Bidding Documents.

*BID BOND* is a security in the form and amount required by the COUNTY pledging that the BIDDER will enter into a Contract with the COUNTY on the terms stated in his Bid.

*BID DOCUMENTS* are the Invitation to Bid, the Notice to Bidders, the Invitation to Bid Terms and Conditions, sample forms, the Bid Proposal Form and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

*CHANGE ORDERS* are written order to the CONTRACTOR signed by the COUNTY, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract price or the Contract Time. The Contract Price and the Contract Time may be changed only by a Change

Order. A Change Order signed by the CONTRACTOR indicates his agreement therewith, including the adjustment in the Contract Price or the Contract Time.

*COMPLETION (FINAL)* means acceptance of the Project by the COUNTY as evidenced by its signature upon a final payment Certification and approval thereof by the Board of County Commissioners or their designee. The final payment Certification shall be signed only after the COUNTY has assured itself by tests, inspections, or otherwise that all of the provisions of the Contract have been carried out as required.

*COMPLETION (SUBSTANTIAL)* shall mean an acceptance of the Work by the COUNTY when construction is sufficiently complete in accordance with the Contract Documents so the COUNTY can occupy or utilize the Work or designated portion thereof for the use for which it is intended. A certificate of occupancy or compliance, when applicable, issued by the Building Official is required concurrent with or prior to issuance of the Certificate of Substantial Completion.

*CONSTRUCTION* is the erection, fabrication, assembly, remodeling, renovation, addition, modification, repair or demolition of any building or structure or any appurtenances connected or attached to such buildings or structures. The term applies but is not limited to the repair, replacement modification or construction of roads, bridges, sidewalks, traffic devices, parking lots, drainage, underground and overhead utilities.

*CONSULTANT* is the person lawfully licensed to practice Architecture or Engineering and registered in the State of Florida, or an entity lawfully practicing Architecture or Engineering, identified as such in the Construction Contract, and is referred to throughout the Contract Documents as if singular in number and masculine in genre. The term CONSULTANT means the Architect or Engineer or his authorized representative.

*CONTRACT DOCUMENTS* consist of the Invitation to Bid, Agreement, General and Special Conditions of the Contract, Specifications, the Plans, Supplemental Information, Addenda issued prior to execution of the Contract, all written modifications issued after execution of the Contract, all provisions required by law to be inserted in this Contract whether actually inserted or not, and a Contract Number issued by the COUNTY.

A *MODIFICATION* is:

- (1) A written Amendment to the Contract.
- (2) A Change Order.
- (3) A written interpretation necessary for the proper execution or progress of the Work issued by the OWNER'S Representative.
- (4) A Field Change Order.
- (5) A Field Directive Change.

*CONTRACT PRICE* means the total monies payable to the CONTRACTOR under the Contract Documents.

*CONTRACT TIME* means the number of Calendar days stated in the Agreement for the purpose of establishing Substantial Completion and Final Completion dates.

*CONTRACTOR* is the person, firm, joint venture, or corporation with whom the COUNTY has contracted and who has the primary responsibility for performance of the work.



*COUNTY* means the Board of County Commissioners of Lee County, Florida, a political subdivision of the State of Florida, its successors and assigns. Also hereinafter referred to as OWNER.

*DAYS* - The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically designated. A calendar day constitutes twenty four hours measured from midnight to the next midnight.

*DEFECTIVE* - An adjective which when modifying the word “Work” refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to the OWNER’S REPRESENTATIVE recommendation of final payment.

*EFFECTIVE DATE OF THE AGREEMENT* means the date on which the agreement is signed and delivered by the latter of the two parties.

*ENGINEER* shall mean the Director of the Lee County Utilities or his designated County Project Manager.

*FIELD CHANGE ORDER* is a written change order requested by the OWNER’S Representative, accepted by the CONTRACTOR, and approved by the PROJECT MANAGER for minor changes in the Work, not involving adjustments in the Contract Sum or an extension of Time, and not inconsistent with the overall intent of the Contract Documents.

*FIELD DIRECTIVE CHANGE* - A written directive to the CONTRACT, issued on or after the effective date of the Agreement ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as defined elsewhere in these documents. A Field Directive Change may not change the Contract Price or the Contract Time, but is evidence that the parties expect that the change directed or documented by a Field Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or the Contract Time.

*FINAL ACCEPTANCE* means acceptance of the Work by the COUNTY upon the expiration of the warranty period as stated in the Contract Documents.

*MATERIALS* - Anything used in the process of, but not limited to, constructing, demolishing, renovating or remodeling of any building, structure, road, bridge, recreational facility, transportation element and utility or any addition thereto utilized for this project.

*NOTICE* means written notice. Notice shall be served upon the CONTRACTOR either personally or by leaving the said Notice at his residence or with his agency in charge of the Work, or addressed to the CONTRACTOR at the residence or place of business stated in the Bid Proposal and deposited in a postpaid wrapper in any United States Mailbox.

*NOTICE TO PROCEED* is a written instrument issued by the COUNTY to the CONTRACTOR, authorizing the CONTRACTOR to commence Work on the Project. The NOTICE TO PROCEED shall include the effective date of Commencement.

*NOTICE OF AWARD* means the written Notice given by the COUNTY to the successful Bidder.

*NOTICE OF TERMINATION* is a written instrument issued in accordance with the Contract Documents by the COUNTY to the CONTRACTOR or by the CONTRACTOR to the COUNTY notifying the receiving party that the Contract is being terminated. The NOTICE shall clearly identify the effective date the Contract is to be terminated.

*OWNER'S REPRESENTATIVE* is the CONSULTANT contracted by the COUNTY for Professional Services during the construction phase of this project or a qualified person authorized as his official representative, or in the absence of such a contract, the project Manager will be considered the OWNER'S REPRESENTATIVE for the purpose of this Contract Document. The OWNER'S REPRESENTATIVE is not authorized to issue change orders to the contract sum, contract time or scope of work without express approval of the Board of County Commissioners.

*PLANS AND/OR DRAWINGS* are a graphic representation of the arrangement of the materials or parts of the construction of the project and are a portion of the Contract Documents.

*PROCUREMENT MANAGEMENT* shall mean the Director of Lee County's Procurement Management Department or designee.

*PROJECT* shall mean the entire improvement of which this contract forms a part.

*PROJECT MANAGER* is an employee of the Department or the COUNTY which requested the Contract and is a designee authorized by or for that Department who is the representative of the Board of County Commissioners in matters concerning the contractor of this project. The project manager will act as the OWNER'S REPRESENTATIVE in the absence of a contract with a CONSULTANT. The PROJECT MANAGER is not authorized to issue changes to the Contract Sum, Contract Time, or Scope of Work without express approval by the Department Director, County Manager, or Board of County Commissioners.

The PROJECT MANAGER, within the authority conferred by the Board of County Commissioners, acting as the COUNTY'S designated representative shall initiate written Change Orders, and notification to the CONTRACTOR of any and all changes approved by the COUNTY in the CONTRACTOR'S (1) compensation (2) time and/or schedule of service delivery; (3) any Amendment (s) or other change(s) relative to the WORK and ADDITIONAL SERVICES pursuant to this Contract, or AMENDMENTS, or CHANGE ORDERS pertaining thereto. Following COUNTY approval, the Project Manager shall coordinate assurance of any such documents. The PROJECT MANAGER or his designee shall be responsible for acting on the COUNTY'S behalf to administer, coordinate, interpret and otherwise manage the contractual provisions and requirements set forth in this Contract, or any AMENDMENT(S), or CHANGE ORDER(S) issued there under.

*SPECIFICATIONS* are written documents organized into divisions, sections, and articles which provide detailed instructions to the CONTRACTOR pertaining, but not limited to, materials, style, workmanship, fabrication, dimensions, colors, warranties, finishes, quality, manufacturer, grade and operational data of all components to be provided by the CONTRACTOR and incorporated into the Project.

*SUB-CONTRACTOR* is a person, firm, partnership, corporation, or entity who has a direct contract with the CONTRACTOR to perform any of the Work at the site. The term Sub-contractor does not

include those whose sole purpose is that of a supplier of materials. A supplier of materials shall be classified as a Sub-contractor if it enters into any agreement, whether written or verbal, for the installation of said materials. The term Sub-contractor means a Sub-contractor or its authorized representative.

*SUPPLIER* - A manufacturer, fabricator, distributor, materialmen or vendor.

*SURETY* is the surety company or individual that is bound by Contract bond with and for the CONTRACTOR who is primarily liable, and is responsible for CONTRACTOR'S acceptable performance of the Project and payment of all debts pertaining to the Contract Documents in accordance with Section 255.05, Florida Statutes.

*UNDERGROUND FACILITIES* - All pipeline, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

*WORK* is the construction required by the Contract Documents and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.

## 2. **Starting the Work**

Written Notice to Proceed is contingent upon and will be done subsequent to the CONTRACTOR fully satisfying the COUNTY'S stated insurance and Bond submittal requirements. Until the CONTRACTOR receives the COUNTY'S written Notice to Proceed, the CONTRACTOR is advised that the COUNTY will not be liable for any expenses which the CONTRACTOR may incur relative to this Contract before the written Notice to Proceed is issued.

- 2.1. The Contract time shall commence to run from the date specified in the "Notice to Proceed".
- 2.2. The CONTRACTOR is required, before commencing the Work, to deliver to the COUNTY the Public Payment and Performance Bond issued by a surety insurer authorized to do business in the State of Florida as Surety. The Bond must state the name and principal business address of both the principal and the Surety and must contain a description of the project sufficient to identify it and post in conspicuous place at the project site.
- 2.3. The COUNTY will forward to the CONTRACTOR a Notice of Commencement along with a copy of the recorded Public Payment and Performance Bond with instructions to post in a conspicuous spot on the project site.

## 3. **Interpretation Intent, Amending and Reuse of Contract Documents**

It is the intent of the Specifications and Plans to describe a complete Project to be constructed in accordance with the Contract Documents.

- 3.1 The Contract Documents are complementary; what is called for by one is as binding as if called for by all. If the CONTRACTOR finds a conflict, error or discrepancy in the Contract

Documents, he shall immediately call it to the attention of the OWNER'S REPRESENTATIVE in writing before proceeding with the Work affected thereby.

- 3.2 Any Work that may be reasonably inferred from the specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for.
- 3.3 Work, materials or equipment described in words which have a well-known technical or trade meaning, shall be deemed to refer to such recognized standards.
- 3.4 In resolving conflicts, errors, and discrepancies, the order of precedence of the Contract Document is as follows:

- (1) Change Order
- (2) Agreement
- (3) Addenda
- (4) Special Conditions
- (5) General Conditions
- (6) Specifications
- (7) Supplemental Information
- (8) Drawings
- (9) Figure Dimensions
- (10) Scale Dimensions (Large Scale Drawings supersede Small Scale Drawings)
- (11) Terms and Conditions

3.5 Amending and Supplementing Contract Documents

The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- 3.5.1 A formal Written Amendment,
- 3.5.2 A Change Order.
- 3.5.3 A Field Directive Change.

The Contract Price and the Contract Time may only be changed by a Change Order or Written Amendment.

3.6 In addition, the requirements of the Contract Documents may be supplemented and minor variations and deviations of the Work may be authorized, in one or more of the following ways:

- 3.6.1 A Field Change Order,
- 3.6.2 The OWNER'S REPRESENTATIVE approval of a Shop Drawing or sample, or
- 3.6.3 The OWNER'S REPRESENTATIVE written interpretation or clarification.

3.7 Reuse of Documents

Neither the CONTRACTOR nor any SUB-CONTRACTOR or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with the COUNTY shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of the

CONSULTANT; and they shall not reuse any of them on extensions of the Project or any other project without written consent of the COUNTY or their CONSULTANT and the specific written verification or adaptation by the CONSULTANT.

#### **4 Availability of Lands**

The COUNTY will furnish, as indicated in the Contract Documents and not later than the date when needed by the CONTRACTOR, the lands upon which the Work is to be done, rights-of-way for access thereto, and such other lands which are designated for the use of the CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained by the COUNTY unless otherwise specified in the Contract Documents. If the CONTRACTOR believes that any delay in the COUNTY'S furnishing these lands or easements entitles him to an extension of the Contract Time, he may make a claim therefore. The CONTRACTOR will provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment unless designated otherwise. The OWNER'S REPRESENTATIVE will, upon request, furnish to the CONTRACTOR copies of all available boundary and topographic surveys as required and sub-surface tests. The CONTRACTOR shall be responsible for staging and storing equipment or materials. All parcels utilized for staging shall be secured. All parcels utilized for staging will be kept in a neat and orderly fashion and then restored to the landowner's satisfaction upon terminating the use of the staging area or improved as noted in the plans. The CONTRACTOR shall maintain on the job site written proof of authorization for the use of any private land. The COUNTY does not condone trespass on private property and will hold the CONTRACTOR liable for any such trespass. Right-of-way maps, if available, of the lands upon which the improvements will be made shall be provided upon request from the OWNER'S REPRESENTATIVE. The CONTRACTOR may use these lands for work associated with this contract only. The CONTRACTOR shall verify the availability of these lands with the Lee County Utilities project manager prior to the issuance of the notice to proceed.

##### **4.1 Physical Conditions**

Explorations and Reports: Reference is made to the Supplemental Information for identification of those reports of explorations and tests of subsurface conditions at the site that have been utilized by the CONSULTANT and/or the COUNTY in preparation of the Contract Documents. These reports are not part of the contract Documents. The CONTRACTOR may rely upon the accuracy of the technical data contained in such reports but not upon the non-technical data, interpretations or opinions contained therein for the completeness or accuracy thereof for the CONTRACTOR'S purposes of preparing or submitting a bid. Except as indicated in the immediately preceding sentence, the CONTRACTOR shall have full responsibility with respect to subsurface conditions at the site. The technical data which will be made available only at the CONTRACTOR'S request may not be sufficient for construction purposes. Additional investigations may be necessary for the purposes of carrying out the construction project.

4.2 Existing Structures: Reference is made to the Supplemental Information for identification of those drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the site that have been utilized by the CONSULTANT and/or the COUNTY in preparation of the Contract Documents. The CONTRACTOR or may rely upon the accuracy of the technical data contained in such drawings but not for the completeness thereof for the purposes of preparing or submitting a bid. Except as indicated in the immediately preceding sentence, the CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

4.3 Unless otherwise stated, the CONTRACTOR shall be fully responsible for the removal

of any materials, debris, garbage, vehicles or other such items which would interfere with the undertaking and completion of the project. By submission of a bid, the CONTRACTOR assumes full responsibility for the expenses associated with such removal. There shall not be an increase in time or price associated with such removal.

4.4 Report of Differing Conditions: If the CONTRACTOR believes that:

4.4.1.1 Any technical data on which the CONTRACTOR is entitled to is inaccurate,  
or

4.4.1.2 Any physical condition uncovered or revealed at the site differs materially from that indicated, reflected or referred to in the Contract Documents.

4.4.1.3 The CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work in connection therewith (except in an emergency as permitted) notify the OWNER'S REPRESENTATIVE in writing about the inaccuracy or difference.

4.5 OWNER'S REPRESENTATIVE Review: The OWNER'S REPRESENTATIVE will promptly review the pertinent conditions, determine the necessity of obtaining additional explorations or tests with respect thereto and advise the COUNTY in writing (with a copy to the CONTRACTOR) of the OWNER'S REPRESENTATIVE'S findings and conclusions.

4.6 Possible Document Change: If the OWNER'S REPRESENTATIVE and the COUNTY conclude that there is a material error in the Contract Documents and a change in the Contract Documents is required, a Field Directive Change, a Field Change or a Change Order will be issued as to reflect and document the consequences of the inaccuracy or difference.

4.7 Possible Price and Time Adjustments: In each case of a material error in the Contract Documents, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to any such inaccuracy or difference.

4.8 Physical Conditions - Underground Facilities

Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to the COUNTY or the CONSULTANT by the owners of such Underground facilities or by others. Unless it is otherwise expressly provided in the Supplemental Information:

4.8.1 The CONTRACTOR shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof and for repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price. The CONSULTANT and COUNTY shall not be responsible for the accuracy or completeness of any such information or data.

4.9 Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents and which the CONTRACTOR could not reasonably have been expected to be aware of, the CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work affected thereby



(except in an emergency as permitted) identify the owner of such Underground Facility and give written notice thereof to that owner and to the OWNER'S REPRESENTATIVE. The OWNER'S REPRESENTATIVE will promptly review the Underground Facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Facility, and with the COUNTY'S approval, the Contract Documents will be amended or supplemented to the extent necessary. During such time, the CONTRACTOR shall be responsible for the safety and protection of such Underground Facility. The CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and which the CONTRACTOR could not reasonably have been expected to be aware of. Locations of existing underground utilities are not field confirmed. In the case of a conflict between this or any other utility and proposed improvements, it shall be the CONTRACTOR'S duty to coordinate with all utility company relocation activities whether shown or not shown in the plans. Coordination is to include efforts by the CONTRACTOR to minimize time lost due to unexpected utility relocation or modifications.

#### 4.10 Reference Points

The COUNTY shall provide engineering surveys to establish reference points, as specified in the Supplemental Information, for construction which in the judgment of the COUNTY and the CONSULTANT are necessary to enable CONTRACTOR to proceed with the Work. The CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified in the Technical Specifications), shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the COUNTY. The CONTRACTOR shall report to the OWNER'S REPRESENTATIVE whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

### 5. Bonds and Insurance

#### 5.1. Public Payment and Performance Bond

The CONTRACTOR will execute the Public Payment and Performance Bonds included herein as security for the faithful performance and payment of all his obligations under the Contract Documents.

#### 5.2. This Bond shall be in amounts at least equal to the Contract Price and in such form and with such securities as are acceptable to the COUNTY. Prior to execution of the Contract Documents, the COUNTY may require the CONTRACTOR to furnish such other bonds, in such form and with such sureties as it may require. If such bonds are required by written instructions given prior to opening of Bids, the Premiums shall be paid by the CONTRACTOR. If the Contract is increased by a Change Order, it shall be the CONTRACTOR'S responsibility to insure that the Public Payment and Performance Bond be amended accordingly and a copy of the amendment forwarded to PROCUREMENT MANAGEMENT.

#### 5.3. If the surety on any bond furnished by the CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Florida or it ceases to meet the requirements imposed by the Contract Documents, the CONTRACTOR shall within five calendar days thereafter substitute another Bond and Surety, both of which shall be acceptable to the COUNTY.

#### 5.4. If the CONTRACTOR cannot obtain another bond and surety within five calendar days the COUNTY will accept and the CONTRACTOR shall submit an irrevocable letter of credit drawn on a Lee County, Florida bank until the bond and surety can be obtained.

## 6 Qualifications of Surety Companies

In order to be acceptable to the COUNTY, a surety company issuing Bid Guaranty Bonds or 100% Public Payment and Performance Bonds, called for in these specifications, shall meet and comply with the following minimum standards:

- 6.1 General
 

All Sureties for Lee County projects must be admitted to do business in the State of Florida and shall comply with the provisions of Florida Statute 255.05.
- 6.2 Attorneys-in-Fact who sign bid bonds or Public Payment and Performance Bonds for Lee County projects must file with such bond a certified copy of their Power of Attorney to sign such bond.
- 6.3 Agents of surety companies must list their name, address, and telephone number on all bonds.
- 6.4 The life of all bonds provided to Lee County shall extend twelve months beyond the date of final payment and shall contain a waiver of alteration to the terms of the Contract, extensions of time and/or forbearance on the part of the COUNTY.
- 6.5 To be acceptable to the OWNER on projects not in excess of \$500,000.00, Surety shall comply with these minimum provisions of State Statute 287.0935 as follows:
  - 6.5.1 Surety must have twice the minimum surplus and capital required by Florida Insurance Code at the time of bid solicitation.
  - 6.5.2 Surety must be in compliance with all provisions of the Florida Insurance Code and hold a currently valid certificate of authority issued by the United States Department of the Treasury under SS.31 U.S.C. 9404-9308.
  - 6.5.3 Sureties on projects in excess of \$500,000.00 shall comply with the above minimum provisions as well as being rated thru A.M. Best shall comply with the following provisions:
    - 6.5.4 The Surety shall be rated as "A-" or better as to General Policyholders Rating and Class VII or better as to financial category by the most current Best's Key Rating Guide, published by A.M. Best Company.
    - 6.5.5 Surety must have fulfilled all of its obligations on all other bonds previously given to the COUNTY.
    - 6.5.6 Surety must have a minimum underwriting limitation of \$5,000,000 published in the latest edition of the Federal Register for Federal Bonds (U.S. Dept. of Treasury).
- 6.6 Letter of Credit
 

At any time during the life of the letter of credit, should the rating of financial institution fall below both of the minimum ratings as indicated in the Contract Documents, or should the financial institution become insolvent, the CONTRACTOR must, within five calendar days after notification by the COUNTY:

  - 6.6.1 Replace the existing letter of credit with a replacement letter of credit from a financial institution with either of the minimum ratings as specified in the Contract Documents, or
  - 6.6.2 Have the existing letter of credit confirmed by a financial institution with either of the minimum ratings as specified in the Contract Documents.
  - 6.6.3 At the COUNTY'S option, the letter of credit may be replaced by a Public Payment and Performance Bond in accordance with the COUNTY'S existing bond policies.
- 6.7 Failure to comply with this provision may result in any or all of the following actions by the COUNTY:

6.7.1 Suspension of the CONTRACTOR’S right to pull building permits and schedule inspections;

6.7.2 A stop work order; and/or Revocation of the Land Development Permit.

6.8 Financial Institutions/Letters of Credit

In order to be acceptable to the COUNTY, a financial institution issuing 100% Letters of Credit, called for in these specifications, shall meet and comply with the following minimum standards:

6.8.1 General

The face of the letter of credit must be in a format utilizing Lee County Standard Form and indicate the following:

- 6.8.1.1 The letter of credit is “clean” and “irrevocable”;
- 6.8.1.2 An exact expiration date. The life of all letters of credit provided to Lee County shall extend twelve months beyond the date of final payment;
- 6.8.1.3 Statement of the purpose or project for which the letter of credit is issued;
- 6.8.1.4 A specific amount of the letter of credit, in U.S. dollars;
- 6.8.1.5 The method of disbursement of draws against the letter of credit;
- 6.8.1.6 The street address where draws against the letter of credit may be made; and
- 6.8.1.7 Venue in Lee County.
- 6.8.1.8 Verification of the status or certification of any financial institution may be made with:

Department of Insurance and Treasurer  
Bureau of Collateral Securities  
200 East Gaines Street  
Tallahassee, FL 32377-0345  
Phone (850) 922-3167

Or

Lee County Procurement Management  
1500 Monroe Street, 4<sup>th</sup> Floor  
Fort Myers, FL 33901  
Phone (239) 533-8881

Or

Lee County Risk Management  
2115 Second Street  
Fort Myers, FL 33901  
Phone (239) 533-2221

6.8.1.9 At the time of issuance of the letter of credit, the financial institution must have a minimum “peer group” rating of 50 in the latest Sheshunoff Quarterly Listing or a minimum rating of 125 in the latest IDC Bank Financial Quarterly Listing.

6.8.1.9.1.1.1 5.7.3 Letters of Credit from financial institutions which do not meet either of the minimum ratings indicated above must be confirmed by a financial institution with either of the minimum ratings indicated above.

6.8.1.9.1.1.2 5.7.4 All financial institutions which issue or confirm any

Letter of Credit must be authorized by the Secretary of State to do business in the State of Florida, shall show proof of same upon request by COUNTY staff, and agree to venue in Lee County.

- 6.8.2 In addition to the institutions meeting the aforementioned requirements, the Federal Home Loan Bank of Atlanta is authorized to issue and confirm letters of credit which are in accordance with the provisions above and all subsequent sub-paragraphs.
- 6.8.3 These actions shall be in effect until a satisfactory replacement bond or letter of credit is accepted by the COUNTY. The CONTRACTOR agreement shall so provide for replacement or confirmation in accordance with this policy.

## **7 Contractor's Liability Insurance**

7.1 The CONTRACTOR will purchase and maintain such insurance as will protect him from claims under Worker's Compensation laws, disability benefit laws or other similar employee benefit laws; from claims for damages because of bodily injury, occupational sickness or disease, or death of his employees including claims insured by usual personal injury, sickness and disease, or death of any person other than his employees including claims insured by usual personal injury liability coverage; and from claims for injury to or destruction of tangible property including loss of use resulting there from any or all of which may arise out of or result from the CONTRACTOR'S operations under the Contract Documents, whether such operations be by himself or any Sub-contractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be legally liable. This insurance shall be written for no less than the limits of liability specified in the Contract Documents or required by law, whichever is greater, and shall include contractual liability insurance. As a prerequisite to the COUNTY signing the Contract, the CONTRACTOR will file with the COUNTY certificates of such insurance, acceptable to the COUNTY; these certificates shall contain a provision for cancellation.

### **7.2 Insurance Requirements**

- 7.2.1 Before final execution of the Agreement and until acceptance of the Work by the COUNTY, the CONTRACTOR shall procure and maintain insurance of the types and the limits specified by the Insurance Guide included in the Solicitation.
- 7.2.2 All CONTRACTOR'S Certificates of Insurance must be approved by the Lee County Risk Manager (or designee) before the final execution of the agreement by the COUNTY.
- 7.2.3 An Insurance Certificate shall be required from the successful BIDDER. Such form must be properly executed and submitted by an authorized representative of the insurance company and successful BIDDER within seven calendar days after notification by Lee County of the Board of County Commissioners' approval to award the contract. Such certificate of insurance state that the coverage is primary, and shall be in the types and amounts stated in the Contract Documents. Certificate should

include producers' phone number and reference the name of the project.

## **8 Contractor's Responsibilities**

### **8.2 Supervision and Superintendence**

- 8.1.1 The CONTRACTOR will supervise and direct the Work efficiently. He will be solely responsible for the means, methods, techniques, sequences, safety, and procedure of construction, unless otherwise specified. The CONTRACTOR will be responsible to see that the finished Work complies with the Contract Documents.
- 8.1.2 The CONTRACTOR will keep on the site at all times when work is being performed, a competent, resident superintendent who shall not be replaced without prior written notice to the OWNER'S REPRESENTATIVE. The superintendent will be the CONTRACTOR'S representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be binding as if given to the CONTRACTOR.

## **9 Labor Material and Equipment**

- 9.1 The CONTRACTOR will provide competent, suitable, qualified personnel to lay out the Work and perform construction as required by the Contract Documents. He will at all times maintain good discipline and order at the site.
- 9.2 The CONTRACTOR will furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, heat, light, telephone, water and sanitary facilities and incidentals necessary for the execution, testing, initial operation and completion of the Work unless otherwise specified. All materials and equipment such as concrete pipe, inlets, manhole covers, etc., furnished by the CONTRACTOR shall be made by the same manufacturer, e.g., all pipe by one company, all inlets by one company, etc.
- 9.3 All materials and equipment will be new except as otherwise provided in the Contract Documents. If required by the OWNER'S REPRESENTATIVE, the CONTRACTOR will furnish satisfactory evidence as to the kind and quality of materials and equipment furnished.
- 9.4 All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturers, fabricator or processors except as otherwise provided in the Contract Documents.
- 9.5 In instances where the act is applicable due to the nature of the bid matter with which this bid package is concerned, all material, equipment, etc., as proposed and offered by CONTRACTOR must meet and conform to all O.S.H.A. requirements; the CONTRACTOR'S signature upon the bid proposal form being by this reference considered a certification of such fact.

## **10 Adjusting the Progress Schedule**

- 10.1 The CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE for acceptance of adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the Contract Documents applicable thereto. The COUNTY reserves the right to reject the progress schedule from the CONTRACTOR which in its judgment does not appear to devote

sufficient resources of manpower to enable the timely completion of the project. If the COUNTY requests the progress schedule to be adjusted, the CONTRACTOR shall do so and perform the work according to the adjusted schedule at no additional cost to the COUNTY.

## **11 Substitute Materials or Equipment**

11.1 If it is indicated in the specifications that the CONTRACTOR may furnish or use a substitute that is equal to any material or equipment specified, and if the CONTRACTOR wishes to furnish or use a proposed substitute, he will, within thirty calendar days after the award of the Contract, make written application to the OWNER'S REPRESENTATIVE for approval of such a substitute, certifying in writing that the proposed substitute will perform adequately the duties imposed by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same function as that specified. No substitute shall be ordered or installed without the written approval of the COUNTY who shall be the judge of quality. Whether or not the COUNTY accepts a proposed substitute, the CONTRACTOR shall reimburse the COUNTY for any charges or cost for evaluating any proposed substitute.

## **12 Concerning Sub-contractors**

12.1 The CONTRACTOR will be fully responsible for all acts and omissions of his SUB-CONTRACTORS and of persons directly or indirectly employed by them and of persons for whose acts they may be liable to the same extent that they are employed by him. Nothing in the Contract Documents shall create any contractual relationship between any SUB-CONTRACTOR and the COUNTY. The COUNTY may, upon request, furnish to any SUB-CONTRACTOR, to the extent practicable, evidence of amounts paid to the CONTRACTOR on account of specific Work done.

12.2 The divisions and sections of the specifications and the identifications of any drawings shall not control the CONTRACTOR in dividing the Work among SUB-CONTRACTORS or delineating the Work to be performed by any specific trade.

12.3 The CONTRACTOR agrees to bind specifically every SUB-CONTRACTOR to the applicable terms and conditions of these Contract Documents for the benefit of the COUNTY.

12.4 All Work performed for the CONTRACTOR by a SUB-CONTRACTOR shall be pursuant to an appropriate agreement between the CONTRACTOR and the SUB-CONTRACTOR which shall contain provisions that waive all rights the contracting parties may have against one another for damages caused by fire or perils covered by insurance, except such rights as they may have to the proceeds of such insurance held by the COUNTY as trustee.

## **13 Patent Fees and Royalties**

13.1 The costs involved in fees, royalties, or claims for any patented invention, article, process or method that may be used upon, or in a manner connected with the work under this contract, shall be paid by the CONTRACTOR. The CONTRACTOR and his sureties, together with his officers, agents, and employees, shall protect and hold the COUNTY harmless against any and all demands made for such fees or claims brought or made by holder of any invention or patent. Before final payment is made on the account of this Contract, the CONTRACTOR shall, if requested by the COUNTY, furnish acceptable proof of a proper release from all such fees or claims.



- 13.2 Should the CONTRACTOR, his agent, employee, or any of them be enjoined from furnishing or using any invention, article, material or plans supplied or required to be supplied or used under this contract, the CONTRACTOR shall promptly pay such royalties and secure the requisite licenses; or, subject to acceptance by the COUNTY, substitute other articles, materials or appliances in lieu thereof which are of equal efficiency, quality, finish, suitability and market value to those planned or required under the contract. Descriptive information of these substitutions shall be submitted to the OWNER'S REPRESENTATIVE for determination of general conformance to the design concept and the construction contract. Should the COUNTY elect to use the substitution, the CONTRACTOR agrees to pay such royalties and secure such valid licenses as may be requisite for the COUNTY, his officers, agents, and employees, or any of them, to use such invention, article, material, or appliance without being disturbed or in any way interfered with by any proceeding in law or equity on account thereof.

## 14 Permits

- 14.1 Unless otherwise specified herein, the CONTRACTOR will secure and pay for all permits, impact fees, and licenses and will pay all governmental charges and inspections' fees necessary for the prosecution of the Work which are applicable at the time of his bid. The CONTRACTOR will also pay all public utility charges and connection fees except as provided for in the Contract Documents. Permits and licenses of regulatory agencies which are necessary to be maintained after completion of the guarantee period shall be secured and paid for by the COUNTY.
- 14.2 Pursuant to the requirements of F.S. 218.80, the following County permits and fees are required to be obtained and paid for by the CONTRACTOR.
- None
- 14.2 This is a disclosure of permits and fees, required by Lee County, for this project and does not relieve the contractor of its responsibility to obtain and pay for permits required by other governmental entities as specified elsewhere in this document.
- 14.3 The CONTRACTOR will give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If the CONTRACTOR observes that the Specifications or Drawings are at a variance therewith, he will give the OWNER'S REPRESENTATIVE prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate modification. If the CONTRACTOR performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations and without such notice to the OWNER'S REPRESENTATIVE, he will bear all cost arising there from; however, it shall not be his primary responsibility to make certain that the Drawings and Specifications are in accordance with such laws, ordinances, rules and regulations.

## 15 Licenses

- 15.1 The CONTRACTOR must be properly licensed, within the jurisdiction where the project is to be constructed, to perform the work specified in the Scope of Work at the time of bid submittal.

**16 Use of Premises**

- 16.1 The CONTRACTOR will confine his equipment, the storage of materials and equipment, and the operations of his workmen to the areas permitted by law, ordinances, permits or the requirements of the Contract Documents and shall not unreasonably encumber the premises with materials or equipment.

**17 Record Drawings**

- 17.1 The CONTRACTOR will keep one record copy of all Specifications, Drawings, Addenda, Modifications and Shop Drawings at the site in good order, and annotated to show all changes made during the construction process or addition and exact location of underground or otherwise concealed components such as, but not limited to, plumbing, air conditioning, electric, culverts, drainage structures, water main, force mains, service lines, wiring, traffic loops, pond or ditch bottoms and banks, signal poles, signs, and conduit which were not installed exactly as shown on the contract drawings. These shall be available to the OWNER'S REPRESENTATIVE and shall be verified by the OWNER'S REPRESENTATIVE at 30%, 60%, and 100% completion of the Project. The CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE one complete set of all recorded changes made during Construction entitled "As-Built", and dated. Submittals shall be made in accordance with the above and shall be submitted at the time of substantial completion.
- 17.2 The sum of \$5,000.00 shall be withheld from the final payment until written acceptance or all of the Record Drawings by the OWNER'S REPRESENTATIVE has occurred.
- 17.3 Certified "as-built" information, which the CONTRACTOR must show on marked-up copies of the design drawings, prints, and other materials as specified above shall include both authorized and unauthorized changes to horizontal pavement dimensions, finish pavement grades, finish dimensions, elevations and alignment of the items noted in Article 17.1, and any modifications to material types from that specified in the bid plans and specifications. As a prerequisite to any payments, the CONTRACTOR shall make available to the Engineer all "as-built" information pertinent to the design drawings each month prior to his submission of a monthly application for payment. The CONTRACTOR shall also obtain "as-built" cross-sections of the roadway, ditches, channels, and other drainage ways as shown in the Contract Documents at intervals not to exceed 100 ft. The CONTRACTOR shall set benchmarks on or within 100 ft. of each control structure constructed as part of this project. A complete description including elevation and location of each control structure benchmark shall be provided to the Engineer as part of the "as-built" information. The elevation shall be clearly and permanently indicated on each benchmark.
- 17.4 "As-built" dimensions and elevations shall be obtained by a Professional Land Surveyor registered in the State of Florida pursuant to Chapter 472, Florida Statutes. The "as-built" drawings shall be signed and sealed by the CONTRACTOR'S Professional Land Surveyor in accordance with Section 472.025, Florida Statutes.
- 17.5 All pertinent surveyors' field survey notes containing the "as-built" data shall be sealed and submitted to the Engineer for review and acceptance prior to authorization of the final payment.
- 17.6 "As-built" data shall be secured and the accuracy of measurements shall be 0.01 ft.
- 17.7 All sub-surface improvements considered part of the Work as shown in the Contract Documents

shall be “as-built” by the CONTRACTOR prior to backfilling.

- 17.8 A final bench level circuit shall be secured indicating accuracy of vertical closure and a copy of these field notes shall be submitted to the Engineer before final acceptance of the project.
- 17.9 The CONTRACTOR shall annotate and show all “as-built” information on 11” x 17” prints of the bid plans during the course of the construction process. Upon completion of all contract work, but prior to authorization of the final payment by the Engineer, the CONTRACTOR shall deliver one (1) set of such annotated, in neat draftsman-like manner, “as-built” 11” x 17” prints to the Engineer for approval. Upon approval of such “as-built” plans, the CONTRACTOR shall forthwith provide two (2) sets of these drawings containing all “as-built” information, a CD of the “as-built” electronic files in AutoCAD or MicroStation format and data which have been sealed by a Professional Land Surveyor by the CONTRACTOR at the CONTRACTOR’S cost and forthwith become the property of the COUNTY.
- 17.10 The cost of preparing, maintaining, and providing “as-built” plans and documents as specified in this Article must be included in the Lump Sum payment for mobilization for each part of the Bid Schedule providing for Mobilization.
- 17.11 Shop drawing submittals processed by the Engineer shall not be construed as Change Orders; the purpose of a shop drawing is to demonstrate to the Engineer that the CONTRACTOR understands the design concept, and that his understanding is demonstrated by indicating the equipment and material to be furnished and installed. Corrections or changes indicated by the Engineer in the shop drawings do not constitute authorization to perform extra work.
- 17.12 The review of shop drawings and schedules shall be considered general and shall not be construed as permitting any departures from the contract requirements. The design drawings and contract specifications shall take precedence over the shop drawings in the event of deviations, discrepancy, or conflict.

## **18 Safety and Protection**

- 18.1 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of and will provide the necessary protection to prevent damage, injury or loss to:
- 18.1.1 All employees on the project and other persons who may be affected thereby;
- 18.1.2 All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site; and
- 18.1.3 Other property at the site or adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- 18.1.4 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection and, in addition, he will comply with all applicable recommendations of the "Manual of Accident Prevention in Construction" published by the

Associated General Contractors of America, Inc.; "Roadway and Traffic Design Standards" latest edition published by the Florida Department of Transportation, specifically Index 600-650; and Occupational Safety and Health Administration published by the United States Department of Labor. He will notify owners of adjacent utilities when prosecution of the Work may affect them. All damage, injury or loss to any property caused directly or indirectly, in whole or in part by the CONTRACTOR, any SUB-CONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable will be remedied by the CONTRACTOR; except any damage or loss attributable to the fault of the Drawings or the Specifications or to the acts or omissions of the COUNTY, and not attributable, directly or indirectly, in whole or in part, to the fault of negligence of the CONTRACTOR.

- 18.1.5 The CONTRACTOR will designate a member of his organization whose responsibility will be to plan for the prevention of accidents at the site. This person shall be the CONTRACTOR'S Superintendent unless otherwise designated in writing by the CONTRACTOR to the OWNER'S REPRESENTATIVE.

## **19 Emergencies**

- 19.1 In emergencies affecting the safety of persons, the Work or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the COUNTY, is obligated to act at his discretion to prevent threatened damage, injury or loss. He will give the OWNER'S REPRESENTATIVE prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby. If the COUNTY and the OWNER'S REPRESENTATIVE determine that a change to the Contract Documents is required because of the action taken in response to an emergency, a Field Directive Change or Change Order shall thereupon be issued covering the changes and deviations involved.

## **20 Shop Drawings and Samples**

- 20.1 After checking and verifying all field measurements, the CONTRACTOR will submit to the OWNER'S REPRESENTATIVE for approval, in accordance with the acceptable schedule of Shop Drawing submission, five copies (or at the option of the OWNER'S REPRESENTATIVE, one reproducible copy) of all Shop Drawings, which shall have been checked by and stamped with the approval of the CONTRACTOR and identified as the OWNER'S REPRESENTATIVE may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the OWNER'S REPRESENTATIVE to review the information as required.
- 20.2 The CONTRACTOR will also submit to the OWNER'S REPRESENTATIVE for approval with such promptness as to cause no delay in the Work, all samples required by the Contract Documents. All samples will have been checked by and

stamped with the approval of the CONTRACTOR, identified clearly as to material, manufacturer, any pertinent numbers and the use for which intended.

- 20.3 At the time of each submission, the CONTRACTOR will in writing call the OWNER'S REPRESENTATIVE'S attention to any deviations that the Shop Drawing or sample may have from the requirements of the Contract Documents and, in addition, shall cause a specific notation to be made on each shop drawing submitted for review and approval of each such variation.
- 20.4 The OWNER'S REPRESENTATIVE will review and approve with reasonable promptness Shop Drawings and Samples, but its review and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The approval of a separate item as such will not indicate approval of the assembly in which the item functions. The CONTRACTOR will make any corrections required by the OWNER'S REPRESENTATIVE and will return the required number of corrected copies of Shop Drawings and re-submit new samples until approved. All cost incurred by the COUNTY for the review of a shop drawing in excess of two reviews shall be the CONTRACTORS responsibility. The CONTRACTOR'S stamp of approval on any Shop Drawing or sample shall constitute a representation to the OWNER'S REPRESENTATIVE that the CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Document.
- 20.5 No work requiring a Shop Drawing or sample submissions shall be commenced until the submission has been approved by the OWNER'S REPRESENTATIVE. Any related Work performed prior to review and approval by the COUNTY of the pertinent submission will be the sole expense and responsibility of the CONTRACTOR. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the OWNER'S REPRESENTATIVE.
- 20.6 The OWNER'S REPRESENTATIVE approval of Shop Drawings or samples shall not relieve the CONTRACTOR from his responsibility for any deviations from the requirements of the Contract Documents, unless the CONTRACTOR has in writing called the OWNER'S REPRESENTATIVE attention to such deviation at the time of submission and the COUNTY and the OWNER'S REPRESENTATIVE have given written approval to the specific deviation; nor shall any approval by the OWNER'S REPRESENTATIVE relieve the CONTRACTOR from responsibility for errors or omissions in the Shop Drawings.
- 20.6.1 The CONTRACTOR shall, upon completion of the work, furnish to the Engineer two (2) complete sets of prints, neatly bound together, and in good condition, of all the CONTRACTOR'S, Subcontractors' and manufacturers' drawings as finally checked and reviewed by the Engineer with all modifications accepted by the



Engineer subsequent thereto, showing the work as actually completed. Such “as-built” information for bridges, culverts, and similar structures shall also be provided by the CONTRACTOR.

## **21 Indemnification**

- 21.1 The CONTRACTOR shall indemnify, save harmless and defend the COUNTY and all of its officers, agents, consultants and employees from and against all losses, claims, demands, payments, suits, actions, recoveries and judgments of every nature and description brought or recoverable against it or them by reason of any act or omission of the CONTRACTOR, his agent, consultants, employees, sub-contractors etc., in the execution of the work or in consequence of any negligence or carelessness in guarding the same and agrees to assume any related cost.
- 21.2 The CONTRACTOR shall assume all risk and bear any loss or injury to property or persons occasioned by neglect or accident during the progress of work until the same shall have been completed and accepted. The CONTRACTOR agrees to repair, restore or rebuild any damages he causes to any property of the COUNTY. He shall also assume all blame or loss by reason of neglect or violation of any state or federal law or municipal rule, regulation or order. The CONTRACTOR shall give to the proper authorities all required notices relating to the work, obtain all official permits and licenses and pay all proper fees. He shall repair any damage that may have occurred to any adjoining building, structure, utility or private property in the course of this work.

## **22 Cleaning Up**

- 22.1 The CONTRACTOR will keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work; at the completion of the Work he will remove all waste materials, rubbish and debris from and about the premises as well as all tools, construction equipment and machinery, and surplus materials, and will leave the site clean and ready for occupancy by the COUNTY. The CONTRACTOR will restore to their original condition those portions of the site not designated for alteration by the Contract Documents.
- 22.2 If the CONTRACTOR fails to clean up as provided in the Contract Documents, the COUNTY may do so and the cost thereof shall be deducted from the final retainage due the CONTRACTOR.

## **23 Continuing the Work**

- 23.1 The CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes and disagreements with the COUNTY. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted (The COUNTY May Stop Work) or as the CONTRACTOR and the COUNTY may otherwise agree in writing.

## **24 Anti-Discrimination**

- 24.1 The CONTRACTOR for itself, its successors in interest, and assignees, as part of the consideration thereof covenant and agree that:



- 24.2 In the furnishing of services to the COUNTY hereunder, no person on the grounds of race, religion, color, age, sex, national origin, handicap or marital status shall be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination.
- 24.3 The CONTRACTOR will not discriminate against any employee or applicant for employment because of race, religion, color, age, sex, national origin, handicap or marital status. The CONTRACTOR will make affirmative efforts to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, age, sex, national origin, handicap or marital status. Such action shall include, but not be limited to, acts of employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination, rates of pay or other forms of compensation and selection for training, including apprenticeships.
- 24.4 CONTRACTOR agrees to post in a conspicuous place, available to employees and applicants for employment, notices setting forth the provisions of this anti-discrimination clause.
- 24.5 CONTRACTOR will provide all information and reports required by relevant regulations and/or applicable directives. In addition, the CONTRACTOR shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the COUNTY to be pertinent to ascertain compliance. The CONTRACTOR shall maintain and make available relevant data showing the extent to which members of minority groups are beneficiaries under these contracts.
- 24.6 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 the COUNTY its efforts made toward obtaining said information. The CONTRACTOR shall remain obligated under this paragraph until the expiration of three years after the termination of this CONTRACT.
- 24.7 In the event of breach of any of the above anti-discrimination covenants, the COUNTY shall have the right to impose sanctions as it may determine to be appropriate, including withholding payment to the CONTRACTOR or canceling, terminating or suspending this CONTRACT, in whole or in part.
- 24.8 Additionally, the CONTRACTOR may be declared ineligible for further COUNTY contracts by rule, regulation or order of the Board of County Commissioners of Lee County, or as otherwise provided by law.
- 24.9 The CONTRACTOR will send to each labor union, or representative of workers with which the CONTRACTOR has a collective bargaining agreement or other contract of understanding, a notice informing the labor union or worker's representative of the CONTRACTOR'S commitments under this assurance, and shall post copies of the notice in conspicuous places available to the employees

and the applicants for employment.

- 24.10 The CONTRACTOR will include the provisions in every sub-contract under this contract to insure its provisions will be binding upon each Sub-contractor. The CONTRACTOR will take such action with respect to any Sub-contractor, as the contracting agency may direct, as a means of enforcing such provisions, including sanctions for non-compliance.

## **25 Work by Others**

- 25.1 The COUNTY may perform additional Work related to the Project by itself, or it may let other direct contracts which shall contain General Conditions similar to these.
- 25.2 The CONTRACTOR will afford the other Contractors who are parties to such direct contracts (or the COUNTY, if it is performing the additional Work itself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of the Work, and shall properly connect and coordinate his work with theirs. Should the Contract entail relocation of facilities not a part of this Contract, the CONTRACTOR will coordinate and cooperate with the applicable entity responsible for this portion of the Work.
- 25.3 Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners at their expense, unless otherwise provided in the Contract. It is understood and agreed that the CONTRACTOR has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans and that no additional compensation will be allowed for any delays, inconveniences, or damage sustained to him due to any interference from the said utility appurtenances or the operation of moving them. If any part of the CONTRACTOR'S work depends (for proper execution) upon the Work of any such other Contractor (or the COUNTY), the CONTRACTOR will inspect and promptly report to the OWNER'S REPRESENTATIVE in writing, any defects, deficiencies or delays in such Work that render it unsuitable for such proper execution and results. His failure to report shall constitute an acceptance of the Work, except as to defects, deficiencies and delays which may appear in the other Work after the execution of his Work.
- 25.4 The CONTRACTOR will do all cutting, fitting and patching of his Work, which is consistent with the Contract Documents that may be required to make its several parts come together properly and fit it to receive or be received by such other Work. The CONTRACTOR will not endanger any Work of others by cutting, excavating or otherwise altering such other Work and will only cut or alter such other work with the written consent of the OWNER'S REPRESENTATIVE.

25.5 If the performance of additional Work by other Contractors or the COUNTY is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional Work.

25.6 The CONTRACTOR shall be responsible for coordination with all activities with adjacent projects.

## **26 Owner's Representative Status During Construction**

### **26.1 County's Representatives**

26.1.1 The COUNTY shall issue all communications to the CONTRACTOR through the OWNER'S REPRESENTATIVE.

### **26.2 Clarifications and Interpretations**

26.2.1 The OWNER'S REPRESENTATIVE will issue with reasonable promptness, through the COUNTY, such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as the COUNTY may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If the CONTRACTOR believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree to the amount or extent thereof, the CONTRACTOR may make a claim.

### **26.3 Authorized Variations in Work**

26.3.1 The OWNER'S REPRESENTATIVE may authorize, with prior approval from the COUNTY minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Change Order and the CONTRACTOR shall perform the Work involved promptly. If the CONTRACTOR believes that a Field Change Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, the CONTRACTOR may make a claim.

## **27. Changes in Work**

27.1 Without invalidating the Agreement, the COUNTY may unilaterally and at any time or from time to time order additions, deletions or revisions in the Work; these will be authorized by Change Orders or Field Directive Change. Upon receipt of a Change Order or Field Directive Change, the CONTRACTOR will proceed with the Work involved.

- 27.2 All such Work shall be executed under the applicable conditions of the Contract Documents.
- 27.3 If any Change Order or Field Directive Change causes an increase or decrease in the Contract Price or any extension or shortening of the Contract Time, an equitable adjustment will be made.
- 27.4 Additional Work performed by the CONTRACTOR without written authorization of a change in the form of an approved Change Order will not entitle him to an increase in the Contract Price or any extension of the Contract Time, except in the case of an emergency.
- 27.5 It is the CONTRACTOR'S responsibility to notify the Surety of any changes affecting the general scope of the Work or change of the Contract Price and the amount of the applicable Bonds shall be adjusted accordingly. The Surety's Acceptance must be submitted to the OWNER'S REPRESENTATIVE, by the CONTRACTOR, within ten calendar days of the initiation of the change.

## **28 Change of Contract Price**

- 28.1 The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by the CONTRACTOR shall be at his expense without change in the Contract Price.
- 28.2 The Contract Price may only be changed by a Change Order. Any claim for an increase or decrease in the Contract Price shall be in writing and delivered to the OWNER'S REPRESENTATIVE within fifteen calendar days of the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty calendar days after such occurrence (unless COUNTY allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR'S written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance. All claims for adjustment in the Contract Price shall be reviewed by the OWNER'S REPRESENTATIVE. Any change in the Contract Price shall be incorporated in a Change Order and approved by the COUNTY. No claim by the CONTRACTOR for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.
- 28.3 Where the Work involved is covered by unit prices contained in the Contract Documents or subsequently agreed upon, by application of unit prices to the quantities of the items involved.
- 28.4 By mutual acceptance of a lump sum properly itemized and supported by

sufficient substantiating data to permit evaluation.

- 28.5 By cost of the Work and mutually acceptable fixed amount for overhead and profit agreed upon by the parties.
- 28.6 If none of the above methods is agreed upon, the value shall be determined by the COUNTY on the basis of cost of the Work and a percentage for overhead and profit. Cost shall only include labor (payroll, payroll taxes, fringe benefits, worker's compensation, etc.), materials, equipment, and other incidentals directly related to the Work involved.
- 28.7 In such cases the CONTRACTOR will submit in the form prescribed by the COUNTY an itemized cost breakdown together with supporting data. The amount of credit to be allowed by the CONTRACTOR to the COUNTY for any such change which results in a net decrease in cost will be the amount of the actual net decrease as determined by the COUNTY. When both additions and credits are involved in any one change, the combined overhead and profit shall be figured on the basis of the net decrease, if any.

## **29 Cash Allowance**

- 29.1 It is understood that the CONTRACTOR has included in the Contract Price any allowances so named in the Contract Documents and shall cause the Work so covered to be done by such materialmen, suppliers, or SUB-CONTRACTORS and for such sums within the limit of the allowances as the COUNTY may approve. Upon final payment, the Contract Price shall be adjusted as required and an appropriate Change Order issued. The CONTRACTOR agrees that the original Contract Price includes such sums as he deems proper for cost and profit on account of cash allowances. No demand for an additional sum for overhead or profit in connection therewith will be allowed.

### **29.2 Unit Price Work**

29.2.1 Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price.

29.2.2 Each unit price will be deemed to include an amount considered by the CONTRACTOR to be adequate to cover the CONTRACTOR'S overhead and profit for each separately identified item.

29.2.3 The unit price of an item of Unit Price Work shall be subject to

reevaluation and adjustment under the following conditions:

- 29.2.3.1 If the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by the CONTRACTOR differs by more than 15% from the estimated quantity of such item indicated in the Agreement; and,
- 29.2.3.2 If there is no corresponding adjustment with respect to any other item of Work; and
- 29.2.3.3 If the CONTRACTOR believes that it has incurred additional expense as a result thereof; or
- 29.2.3.4 If the COUNTY believes that the quantity variation entitles it to an adjustment in the unit price, either the COUNTY or the CONTRACTOR may make a claim for an adjustment in the Contract Price if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

### **30 Change of Contract Time**

30.1 The Contract Time may only be changed by a Change Order. Any claim for an extension in the Contract Time shall be in writing and delivered to the OWNER'S REPRESENTATIVE within fifteen calendar days of the occurrence of the event giving rise to the claim and stating general nature of the claim. Notice of the extent of the claim with supporting data (analysis and documentation) shall be delivered within sixty calendar days after such occurrence (unless the OWNER'S REPRESENTATIVE allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR'S written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. If adverse weather conditions are the basis for a claim for additional time, such claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that the weather conditions had an adverse effect on the scheduled construction. No claim by the CONTRACTOR under this provision shall be allowed unless the CONTRACTOR has given the notice and the analysis and documentation required in this paragraph. All claims for adjustment in the Contract Time shall be determined by the OWNER'S REPRESENTATIVE. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

30.2 The COUNTY shall not be responsible for any delay in the completion of the



project where the delay is beyond the control or without fault or negligence on behalf of the COUNTY. The COUNTY shall not be held accountable for extra compensation or an extension of time due to default by the CONTRACTOR, SUB-CONTRACTORS, or suppliers in the furnishing of labor or materials for the project, or having to replace defective materials.

- 30.3 The CONTRACTOR shall be entitled to a claim for an extension of time when a delay or hindrance is caused by an act of God, or any act or omission on the part of the COUNTY, provided the CONTRACTOR gives notice to the OWNER'S REPRESENTATIVE within fifteen calendar days of the occurrence of the event giving rise to the claim and having stated the general nature of the claim. The CONTRACTOR'S sole remedy shall be an extension of Contract Time.
- 30.4 No extension of Contract Time or increases in Contract Price shall be granted for any delay caused either by (1) inadequate crewing, default or bankruptcy of lower tier contract, slow submittals, etc., or (2) by severe though not unusual weather conditions (other than hurricanes and tornadoes) or (3) any delay impacting a portion of the Work within the available total float or slack time and not necessarily preventing completion of the Work within the Contract Time unless otherwise agreed to by the COUNTY in its sole discretion or (4) for any delay which is caused by the CONTRACTOR having to replace defective material or equipment or (5) delays attributable to the lack of performance by Sub-contractors regardless of the reasons.
- 30.5 All time limits stated in the Contract Documents are of the essence of the Agreement. Shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court cost) for delay by either party.

### **31 Warranty and Guarantee: Acceptance of Defective Work**

#### 31.1 Warranty and Guarantee

31.1.1 The CONTRACTOR warrants and guarantees to the COUNTY that all materials and equipment will be new unless otherwise specified and that all Work will be of good quality, free from faults or defects and in accordance with the requirements of the Contract Documents and any inspections, test or approvals referred to in this Article. All unsatisfactory Work, all faulty Work, and all Work not conforming to the requirements of the Contract Documents or such inspections, tests or approvals shall be considered defective. Prompt notice of all defects shall be given to the CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided herein. Contractor is to assign any and all warranties or guarantees on equipment, materials, etc. to the COUNTY.

#### 31.2 Tests and Inspections

- 31.2.1 If the Contract Documents, laws, ordinances, rules, regulations or order of any public authority having jurisdiction require any Work to specifically be inspected, tested or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the OWNER'S REPRESENTATIVE forty-eight (48) hours' notice of readiness therefore. The CONTRACTOR will furnish the OWNER'S REPRESENTATIVE with the required certificates of inspection, testing or approval. All such tests will be in accordance with the methods prescribed by the American Society for Testing and Materials or such other applicable organizations as may be required by law or the Contract Documents. If any such Work required to be inspected, tested or approved is covered without written approval of the OWNER'S REPRESENTATIVE, it shall, if requested by the OWNER'S REPRESENTATIVE, be uncovered for observation at the CONTRACTOR'S expense. The cost of all such inspections, tests and approvals shall be borne by the CONTRACTOR unless otherwise provided.
- 31.2.2 Project field testing of materials required by the specifications or the OWNER'S REPRESENTATIVE shall be provided by and at the expense of the COUNTY. The CONTRACTOR shall coordinate and schedule the required testing. The Contractor shall pay for all retests when the initial test result reveals that the materials failed to meet the requirements of the specifications. The CONTRACTOR shall notify the OWNER'S REPRESENTATIVE twenty-four (24) hours prior to conducting any test so the OWNER's REPRESENTATIVE may be present.
- 31.2.3 The OWNER'S REPRESENTATIVE shall have the right to require all materials to be submitted to tests prior to incorporation in the Work. In some instances, it may be expedient to perform these tests at the source of supply, and for this reason, it is required that the CONTRACTOR furnish the OWNER'S REPRESENTATIVE with the information concerning the location of his source before incorporating material into the Work. This does not in any way obligate the OWNER'S REPRESENTATIVE to perform tests for acceptance of material and does not relieve the CONTRACTOR of his responsibility to furnish satisfactory material. The CONTRACTOR shall furnish manufacturer's certificates of compliance with these specifications covering manufactured items incorporated in the Work.
- 31.2.4 Neither observations by the OWNER'S REPRESENTATIVE, nor inspections, tests or approvals by persons other than the CONTRACTOR shall relieve the CONTRACTOR from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

31.2.5 Testing/Permits: The CONTRACTOR shall be responsible for performing any testing and the cost for all items that may be required as part of the NPDES, FDEP, USACOE and SFWMD permits.

## **32 Close Out Procedure**

### **32.1 General Operating/Maintenance Instructions & Manuals**

32.1.1 The CONTRACTOR shall organize maintenance operating manual information into four suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Emergency instructions, spare parts listing, warranties, wiring diagrams, recommended "turn around" cycles, inspection procedures, shop drawings, product data, and similar acceptable information shall be included. The CONTRACTOR shall bind each manual of each set in a heavy duty, 3-ring vinyl covered binder, and include pocket folders for folded sheet information. Mark identification on both front and spine of each binder.

32.1.2 Arrange for each installer of work requiring continuing maintenance (by the OWNER) or operation, to meet with the OWNER'S personnel, at the project site, to provide basic instructions needed for proper operation and maintenance of the entire work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations. Review maintenance and operations in relation with applicable guaranties, warranties, agreements to maintain, bonds, and similar continuing commitments.

## **33 Access to the Work**

33.1 The COUNTY and the OWNER'S REPRESENTATIVE shall at all times have access to the Work. The CONTRACTOR shall provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof by others.

## **34 Uncovering the Work**

34.1 If any work has been covered which the OWNER'S REPRESENTATIVE has not specifically requested to observe prior to its being covered, or if the OWNER'S REPRESENTATIVE considers it necessary or advisable that covered Work be inspected or tested by others, the CONTRACTOR, at the OWNER'S REPRESENTATIVE'S request, will uncover, expose or otherwise make available for observation, inspection or testing as the OWNER'S REPRESENTATIVE may require, that portion of the Work in question,

furnishing all necessary labor, material and equipment. If it is found that such Work is defective, the CONTRACTOR will bear all the expense of such uncovering, exposure, observation, inspection and testing, and of satisfactory reconstruction. If, however, such Work is not found to be defective, the CONTRACTOR will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction, if he makes a claim therefor.

### **35 County May Stop Work**

- 35.1 If the Work is defective, if the CONTRACTOR fails to supply sufficient skilled workmen or suitable materials or equipment, or if the CONTRACTOR fails to make prompt payments to SUB-CONTRACTORS for labor, materials or equipment: the COUNTY may order the CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the COUNTY to stop the work shall not give rise to any duty on the part of the COUNTY to exercise this right for the benefit of the CONTRACTOR or any other party.
- 35.2 Notwithstanding Paragraph 35.1, the COUNTY may also issue a Stop Work Order for the following reasons:
- 35.2.1 Insufficient Maintenance of Traffic practices.
  - 35.2.2 Failure to comply with permits regarding pollution control.
  - 35.2.3 Insufficient construction materials or methods.
  - 35.2.4 Failure to provide a safe working environment in accordance with the US Department of Labor Occupational Safety and Health Administration (OSHA).
- 35.3 Upon notice of the Stop Work Order, the CONTRACTOR shall cease all contracted work except for the activities required to correct the problem and as directed by the COUNTY.
- 35.4 If the CONTRACTOR fails to correct the problem causing the Stop Work Order and there is immediate threat to the public's health, safety, or environmental protection, the COUNTY may perform any remedial activities necessary to protect the public and environment. Any costs incurred by the County in the performance of this work shall be deducted from monies due the Contractor or paid by the Contractor to the County.
- 35.5 No increase in the Contract Price or extension of the Contract Time will be granted for any delays or loss of time due to a Stop Work Order.

### **36 Correction of Removal of Defective Work**

- 36.1 If required by the OWNER'S REPRESENTATIVE prior to approval of final payment, the CONTRACTOR will, promptly, without cost to the COUNTY and as specified by the OWNER'S REPRESENTATIVE, either correct any defective

Work whether or not fabricated, installed or completed or, if the Work has been rejected by the OWNER'S REPRESENTATIVE, remove it from the site and replace it with non-defective Work. If the CONTRACTOR does not correct such defective Work or remove and replace such rejected Work within ten calendar days, all as specified in a written notice from the OWNER'S REPRESENTATIVE, the OWNER'S REPRESENTATIVE may have the deficiency corrected or the rejected Work removed and replaced. All direct or indirect costs of such correction or removal and replacement shall be paid by the CONTRACTOR. The CONTRACTOR will also bear the expense of making good all Work of others destroyed or damaged by his correction, removal or replacement of his defective Work.

### **37 One Year Correction Period**

- 37.1 If, after the approval of the final payment and prior to the expiration of one year after the date of Final Completion or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, the CONTRACTOR will promptly, without cost to the COUNTY, and in accordance with the OWNER'S REPRESENTATIVE'S written instructions, either correct such defective Work or, if it has been rejected by the OWNER'S REPRESENTATIVE, remove it from the site and replace it with non-defective Work. If, within seven calendar days, the CONTRACTOR does not comply with the terms of such instructions, the Bonding Company shall be notified of default and requested to make repairs or replacement, the COUNTY may have the defective Work corrected or the rejected Work removed and replaced. All direct and indirect costs of such removal and replacement shall be paid by the CONTRACTOR.

### **38 Acceptance of Defective Work**

- 38.1 If, instead of requiring correction or removal and replacement of defective Work, the COUNTY prefers to accept it, the COUNTY may do so. In such case, if acceptance occurs prior to approval of final payment, a Change Order shall be issued incorporating the appropriate revisions to the Contract Documents including an appropriate reduction in the Contract Price. If the acceptance occurs after approval of the final payment, an appropriate amount shall be paid by the CONTRACTOR to the COUNTY.

### **39 Neglected Work By Contractor**

- 39.1 If the CONTRACTOR should neglect to prosecute the Work in accordance with the Contract Documents, including any requirements of the progress schedule, the COUNTY may, after three calendar days written notice to the CONTRACTOR and without prejudice to any other remedy it may have, make good such deficiency and the cost thereof shall be charged against the CONTRACTOR. A Change Order shall be issued incorporating the appropriate revision to the Contract Documents including an appropriate reduction in the Contract Price. If the payments then or thereafter due the CONTRACTOR are

not sufficient to cover such amount, the CONTRACTOR shall pay the difference to the COUNTY.

#### **40 Payment and Completion**

##### **40.1 Schedule of Values**

40.1.1 Within ten (10) calendar days after the effective date of the Agreement, the CONTRACTOR must submit a schedule of values of the Work including quantities and unit prices totaling to the Contract Price. This schedule shall be satisfactory in form and substance to the COUNTY and shall subdivide the Work into sufficient detail to serve as the basis for progress payments during construction. Upon approval of the schedule of values by the OWNER'S REPRESENTATIVE, it shall be incorporated into the Estimate and Requisition for Payment prescribed by the COUNTY. Unit Price Contracts shall have the bid proposal prices incorporated into the Estimate and Requisition for Payment.

##### **40.2 Application for Progress Payment**

40.2.1 Bid proposal units and unit prices shall serve as the basis for progress payments during construction. The bid proposal process shall be incorporated into the Estimate and Requisition for Payment Form No. CSD:505(4) prescribed by the COUNTY.

40.2.2 Not more often than once a month, nor less often than specified in the approved payment schedule, and on a date established at the Project Pre-Construction Conference, the CONTRACTOR will submit to the OWNER'S REPRESENTATIVE for review the Estimate and Requisition for Payment form filled out and signed by the CONTRACTOR covering the Work completed as of the date of the Application and supported by such data as the OWNER'S REPRESENTATIVE may reasonably require. Also, if payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such supporting data, satisfactory to the OWNER'S REPRESENTATIVE, as will establish the COUNTY'S title to the material and equipment and protect its interest therein, including applicable insurance. All progress payments will be subject to the retainage percentage specified in the Contract Documents. Such retainage shall be paid and will be issued in the final payment after acceptance by the COUNTY of the Work.

#### **41 Contractor's Warranty of Title**

41.1 The CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by an application for progress payment, whether incorporated in the Project or not, will be passed to the COUNTY prior to the



next making of application for progress payment, free and clear of all liens, claims, security interest and encumbrances; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the CONTRACTOR or by any other person performing the Work at the site or furnishing materials and equipment for the Project subject to an agreement under which an interest therein or encumbrance thereon is retained by the seller or otherwise imposed by the CONTRACTOR or such other person.

## **42 Approval of Payments**

- 42.1 The OWNER'S REPRESENTATIVE will, within ten calendar days after receipt of each Application for Payment, either indicate his approval of payment and deliver the application to the COUNTY or return the Application to the CONTRACTOR indicating in writing the reason for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and re-submit the Application. The COUNTY will, within five calendar days after receipt of each approved application for payment, either indicate their approval of payment, and within fifteen calendar days pay the CONTRACTOR the amount approved, or return the application to the CONTRACTOR thru the OWNER'S REPRESENTATIVE indicating in writing the reason for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the application to the OWNER'S REPRESENTATIVE.
- 42.2 The OWNER'S REPRESENTATIVE'S approval of any payment requested in an Application for Payment shall constitute a representation by him to the COUNTY, based on the OWNER'S REPRESENTATIVE'S on-site observations of the Work in progress and on his review of the Application for Payment and the supporting data that the CONTRACTOR is entitled to payment of the amount approved.
- 42.3 The OWNER'S REPRESENTATIVE'S approval of final payment shall constitute an additional representation by him to the COUNTY that the conditions precedent to the CONTRACTOR'S being entitled to final payment as set forth have been fulfilled.
- 42.4 The OWNER'S REPRESENTATIVE may refuse to approve the whole or any part of any payment if in his opinion; he is unable to make such representations to the COUNTY. He may then refuse to approve any such payment because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously approved, to such extent as may be necessary in his opinion to protect the COUNTY from loss because:
- 42.4.1 The Work is defective;
- 42.4.2 A portion of such payment is the subject of a dispute or claim that has been filed;

42.4.3 The Contract Price has been reduced because of Modifications;

42.4.4 The COUNTY has been required to correct defective Work or complete the Work, or of unsatisfactory prosecution of the Work, including failure to clean up as required.

### **43 Substantial Completion**

- 43.1 Prior to final payment, the CONTRACTOR shall, in writing to the OWNER'S REPRESENTATIVE, certify that the entire Project is substantially complete and request that the OWNER'S REPRESENTATIVE issue a Certificate of Substantial Completion. Within fourteen calendar days thereafter, the OWNER'S REPRESENTATIVE and the CONTRACTOR will make an inspection of the Project to determine the status of completion. If the COUNTY does not consider the Project substantially complete, it will notify the CONTRACTOR in writing giving the reasons therefore. If the COUNTY considers the Project substantially complete, a Certificate of Substantial Completion will be issued. This certificate shall fix the date of Substantial Completion and the responsibilities between the COUNTY and the CONTRACTOR for maintenance, heat and utilities. The Certificate of Substantial Completion will also include a punch list of items to be completed or corrected, said time to be within the Contract Time. The COUNTY shall have the right to exclude the CONTRACTOR from the Project after the date of Substantial Completion but the COUNTY will allow the CONTRACTOR reasonable access to complete items on the punch list.

### **44 Partial Utilization**

- 44.1 Prior to final payment, the OWNER'S REPRESENTATIVE may request the CONTRACTOR to permit the use of a specified part of the Project which the COUNTY believes it may use without significant interference with construction of the other parts of the Project. If the CONTRACTOR agrees, he will certify to the OWNER'S REPRESENTATIVE that said part of the Project is substantially complete and request the OWNER'S REPRESENTATIVE to issue a Certificate of Substantial Completion for that part of the Project. Within fourteen calendar days thereafter, the OWNER'S REPRESENTATIVE and the CONTRACTOR will make an inspection of that part of the Project to determine its status of completion. If the COUNTY considers that part of the Project to be substantially complete, the OWNER'S REPRESENTATIVE will deliver to the CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion as to that part of the Project, and listing the punch list of items to be completed or corrected before final payment and fixing the responsibility between the COUNTY and the CONTRACTOR for maintenance, heat and utilities as to that part of the Project. The COUNTY shall have the right to exclude the CONTRACTOR from any part of the Project which is so certified to be substantially complete but the COUNTY will allow the CONTRACTOR reasonable access to complete or correct items on the punch list.

## **45 Final Inspection**

- 45.1 Upon written notice from the CONTRACTOR that the Project is complete, the OWNER'S REPRESENTATIVE will make a final inspection with the CONTRACTOR and will notify the CONTRACTOR in writing of any particulars which this inspection reveals that the Work is defective. The CONTRACTOR shall immediately make such corrections as are necessary to remedy the defects within a reasonable time.

## **46 Final Inspection for Payment**

- 46.1 After the CONTRACTOR has completed any such corrections to the satisfaction of the OWNER'S REPRESENTATIVE and delivered all maintenance and operating instructions, schedules, guarantees, bonds, Certificates of Inspection and other documents as required by the Contract Documents, he may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by legally effective final releases or waivers of liens from the CONTRACTOR and all SUB-CONTRACTORS which performed services for the CONTRACTOR pursuant to the Contract Documents and the consent of surety, if applicable to final payment.

## **47 Approval of Final Payment**

- 47.1 If, on the basis of its observations and review of the Work during construction, its final inspection and its review of the final Estimate and Requisition for Payment, all as required by the Contract Documents, the OWNER'S REPRESENTATIVE is satisfied that the Work has been completed and the CONTRACTOR has fulfilled all of his obligations under the Contract Documents, it will, within ten calendar days after receipt of the final Application for Payment, indicate in writing its approval of payment and deliver the application to the COUNTY. Otherwise, it will return the Application to the CONTRACTOR, indicating in writing its reason for refusing to approve final payment, in which case the CONTRACTOR will make the necessary corrections and re-submit the Application. The COUNTY will, within fifteen calendar days after receipt of approved application for final payment, either indicate their approval of the estimate and requisition application for payment and within fifteen calendar days pay the CONTRACTOR the amount approved by the COUNTY and issue a Certificate of Final Completion or return the application thru the OWNER'S REPRESENTATIVE indicating in writing the reason for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the application to the OWNER'S REPRESENTATIVE.
- 47.2 If, after substantial Completion of the Work, final completion is materially delayed through no fault of the CONTRACTOR, and the OWNER'S REPRESENTATIVE so confirms, the COUNTY shall and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully

completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the CONTRACTOR to the OWNER'S REPRESENTATIVE, prior to certification of such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

- 47.3 If liquidated damages are to be deducted from the final payment, the COUNTY shall so notify the CONTRACTOR in writing at least seven calendar days prior to the COUNTY'S submittal to Finance.
- 47.4 The Contractor will be required to submit with his final payment documents a DBE Participation Certification, indicating all DBE sub-contractor(s) and amount(s) utilized for the project.
- 47.5 If the CONTRACTOR did not utilize the DBE firm(s) listed on the Bid Proposal, a letter of justification, as to why shall be submitted along with the DBE Participation Certification.
- 47.6 At the final completion of the construction project if the county project manager experienced problems with the CONTRACTOR the project manager will prepare a Contractor Performance Evaluation, and forward to the Contractor for review, comment and signature.
- 47.7 Upon receipt of the Contractor Performance Evaluation the CONTRACTOR will have seven calendar days, from the date received, to review, comment, sign and return back to the project manager. If the evaluation has not been received back from the CONTRACTOR within the seven calendar days, the COUNTY will assume the CONTRACTOR fully agrees with and has no comments to the evaluation. The evaluation will then be placed on file with Lee County Procurement Management.

#### **48 Contractor's Continuing Obligation**

- 48.1 The CONTRACTOR'S obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval of any progress or final payment by the COUNTY, the issuance of the Certificates of Completion, any payment by the COUNTY to the CONTRACTOR under the Contract Documents, any use or occupancy of the Project or any part thereof by the COUNTY, any act of acceptance by the COUNTY, any failure to do so, nor any correction of defective Work by the COUNTY shall constitute an acceptance of Work not in accordance with the Contract Documents.

#### **49 Waiver of Claims**

- 49.1 The making and acceptance of final payment shall constitute:

49.1.1 A waiver of all claims by the COUNTY against the CONTRACTOR other than those arising from unsettled liens, from defective Work appearing after final payment or from failure to comply with the requirements of the Contract Documents, or from the terms of any special guarantees specified therein, and,

49.1.2 A waiver of all claims by the CONTRACTOR against the COUNTY other than those previously made in writing and still unsettled.

## **50 Suspension of Work and Termination**

### **50.1 County May Suspend Work**

50.1.1 The COUNTY may at any time and without cause suspend the Work or any portion thereof for a period of not more than ninety calendar days by notice in writing to the CONTRACTOR. The COUNTY shall fix the date on which Work shall be resumed and the CONTRACTOR will resume the Work on the date so fixed. The CONTRACTOR will be allowed an increase in the Contract Price, an extension of the Contract Time or both, if such increases are justified and directly attributable to any COUNTY suspension and if he makes a claim thereof.

## **51 County May Terminate**

51.1 If the CONTRACTOR is adjudged bankrupt or insolvent, if he makes a general assignment for the benefit of his creditors, if a trustee or receiver is appointed for the CONTRACTOR or for any of his property, if he files a petition to take advantage of any debtor's act or reorganizes under the bankruptcy or similar laws, if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, if he repeatedly fails to make prompt payments to SUB-CONTRACTORS for labor, materials or equipment, if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction, if he disregards the authority of the OWNER'S REPRESENTATIVE, or if he otherwise substantially violates any provisions of the Contract Documents, then the COUNTY may, without prejudice to any other right or remedy and after giving the CONTRACTOR and his surety seven (7) calendar days' written notice, terminate the services of the CONTRACTOR and take possession of the Project and all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR and finish the Work by whatever method the COUNTY may deem expedient or arrange with the Surety to complete the project. The CONTRACTOR, if notified by the COUNTY to do so, shall promptly remove any part of his equipment and supplies from the property of the COUNTY; failing, the COUNTY shall have the right to remove such equipment and supplies at the expense of the CONTRACTOR.

51.2 In such case the CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect cost of completing the Project, including

compensation for additional professional services, such excess shall be paid to the CONTRACTOR. If such cost exceeds such unpaid balance, the CONTRACTOR will pay the difference to the COUNTY. Such cost incurred by the COUNTY will be determined by the COUNTY and incorporated in a Change Order.

- 51.3 Where the CONTRACTOR'S services have been so terminated by the COUNTY, said termination shall not affect any rights of the COUNTY against the CONTRACTOR then existing or which may thereafter accrue.
- 51.4 If so terminated, any retention or payment of monies by the COUNTY due the CONTRACTOR will not release the CONTRACTOR from liability accruing under this Contract.
- 51.5 If after notice of termination of the CONTRACTOR'S right to proceed under the provisions of this clause, it is determined for any reason that the CONTRACTOR was not in default under the provisions or that the delay was excusable, the rights and obligations of the parties shall be the same as if the notice of termination had not been issued.
- 51.6 Upon thirty (30) calendar days' written notice to the CONTRACTOR, the COUNTY may without cause and without prejudice to any other right or remedy elect to abandon the Project and terminate the Agreement. In such case the CONTRACTOR shall be paid for all Work executed and any expense sustained plus a reasonable profit.

## **52 Contractor May Stop Work or Terminate The Contract**

- 52.1 If through no fault of the CONTRACTOR, or a Sub-contractor, or their agents or employees or any other persons performing portions of the Work under Contract with the CONTRACTOR, the WORK is suspended for a period of more than ninety calendar days by the COUNTY or under an order of court or other public authority, or the OWNER'S REPRESENTATIVE has not issued a certificate for payment and has not notified the CONTRACTOR of the reason for withholding certification or because the COUNTY has not made payment on a certificate for payment within the time stated in the Contract Documents, then the CONTRACTOR may, upon seven calendar days written notice to the COUNTY and the OWNER'S REPRESENTATIVE, terminate the Agreement and recover from the COUNTY payment for all Work executed and proven loss with respect to materials, equipment, tools and construction equipment and machinery, including reasonable overhead, profit and damages.
- 52.2 In addition and in lieu of terminating the Agreement, if the OWNER'S REPRESENTATIVE has failed to act on an application for payment or the COUNTY has failed to make any payment as aforesaid, the CONTRACTOR may upon seven calendar days written notice to the COUNTY and the OWNER'S REPRESENTATIVE stop the Work until payment of all amounts



then due. The provisions of this paragraph shall not relieve the CONTRACTOR of the obligation to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with the COUNTY.

### **53 Miscellaneous**

#### **53.1 General**

53.1.1 All Specifications, Drawings and copies thereof furnished by the COUNTY, to the CONTRACTOR, shall remain the COUNTY'S property. They shall not be used on another Project.

53.1.2 The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder, and, in particular but without limitation, the warrants, guarantees and obligations imposed upon the CONTRACTOR and the rights and remedies available to the COUNTY thereunder shall be in addition to and not a limitation of any otherwise imposed or available by law, by special guarantee or other provisions of the Contract Documents.

53.1.3 Should the COUNTY or the CONTRACTOR suffer injury or damage to its person or property because of any error, omission or act of the other or any of his employees, agents, or others for whose acts he is legally liable, claim should be made in writing to the other party within seven calendar days of the first observance of such injury or damage.

53.1.4 The Contract Documents shall be governed by the laws of the State of Florida, the County of Lee, and the municipality in which the project is being done.

53.2 Right-of-Way Station Boards: The CONTRACTOR must establish and maintain throughout construction the right-of-way station boards at every even station within ten (10) days after the Notice to Proceed to assist and expedite construction and utility coordination. No additional compensation or separate pay item will be made for this work.

53.3 Abbreviations: Reference in the technical specifications to the specifications or requirements of technical societies, associated organization, or bodies shall mean their most current specifications. These groups are identified in the technical specifications.

53.4 Use of Public Streets: The use of public streets and roads shall be such as to minimize any inconvenience to the public and to other traffic. Any earth or other excavation materials spilled from trucks shall be removed by the CONTRACTOR and the streets and roads shall be cleaned by the CONTRACTOR to the satisfaction of the COUNTY.

53.5 Damage to Existing Property, Structures and Utilities: The CONTRACTOR shall

be held responsible for and shall repair all damage to pavement beyond the limits of the contract or outside the right-of-way. Also, the CONTRACTOR shall repair if damaged buildings, telephone or other cables, poles, signs, mailboxes, irrigation piping, water pipes, sanitary pipes, or other structures which may be encountered, whether or not they are shown on the Drawings. Information shown on the Drawings as to the location of existing utilities has been prepared from the most reliable data available to the Engineer. However, this information is not guaranteed, and it shall be the CONTRACTOR'S responsibility to determine the location, character, and depth of any existing utilities. The CONTRACTOR shall assist the utility companies, by every means possible, to determine said locations. The CONTRACTOR shall exercise extreme caution to eliminate any possibility of any damage to utilities resulting from his activities.

53.5.1 At least two (2) business days prior to excavating any section of the Work, the CONTRACTOR shall call the utility companies noted on the plans and inform them that Work on the specific section is about to commence and request that they field locate their underground utilities.

53.5.2 When proceeding with the Work, the CONTRACTOR shall exercise due caution to protect all underground and overhead utilities and existing structures from damage. In keeping with the Trench Safety Act, the CONTRACTOR shall provide all sheeting, shoring, and bracing that may be required to properly protect adjacent property, structures and people. The CONTRACTOR shall repair, to the satisfaction of the OWNER, any surface or subsurface Improvement damaged during the course of the Work (unless such improvement is shown to be abandoned or removed) whether or not such improvement is shown on the Drawing. Should any utilities be encountered that are not shown on the Drawing, the CONTRACTOR shall immediately notify the OWNER'S REPRESENTATIVE and shall take all due caution necessary to protect the utility.

53.6 Adjustment of Grades: Adjustments of grades shown on Drawings may be necessary to conform to actual field conditions or to maintain cover under proposed future grades. Such adjustments shall be considered part of the job conditions and no extra compensation will be allowed for such changes, except where specifically otherwise noted in the plans or specifications. Such adjustments must be approved by the OWNER'S REPRESENTATIVE prior to being made.

53.7 Existing Drainage: Existing drainage shall be maintained at all times and drainage under construction shall be left open so as not to cause flooding due to blockage. Any damage to construction caused by this requirement shall be the responsibility of the CONTRACTOR.

53.8 Reference to Other Specifications

53.8.1 Reference to AASHTO and ASTM are to the latest editions of published text of the American Association of Highway and Transportation Officials and the American Society for Testing and Materials, respectively.

### 53.9 Shoring

53.9.1 Unless trench banks are cut back on a stable slope, sheet and brace trenches shall be used as necessary to prevent caving or sliding, to provide protection for workmen and the pipe, and to protect adjacent structures and facilities. The CONTRACTOR shall not brace sheeting against the pipe, but shall brace it so that no concentrated loads of horizontal thrust are transmitted to the pipe. If portable metal box is used for bracing the slopes, the CONTRACTOR shall take care not to disturb the pipe when the box is removed.

53.9.2 The CONTRACTOR must comply with the Trench Safety Act, Florida Statutes Sections 553.60 – 553.64. Cost of compliance is not a separate pay item. Costs shall be included in the cost of pipe placement.

53.10 Dewatering: Dewatering of excavations, trenches, structures and utilities may be required. The CONTRACTOR shall be responsible for obtaining water use permits for dewatering operations, as necessary, from the South Florida Water Management District. No separate payment will be made for dewatering operations or procurement of dewatering permits. Costs shall be included in the cost of items as included in the Bid Form.

53.11 Excess Excavated Material: Unless otherwise specified, all excavated material in excess of the needs for backfill and area fill shall become the property of the CONTRACTOR, and the CONTRACTOR shall remove same from the project.

53.12 Asphalt Paving Conference: A pre-paving conference shall be held prior to any asphalt placement. The conference is intended to closely coordinate the CONTRACTOR'S plant and site personnel with the COUNTY'S plant and field inspectors and establish expected quality assurance procedures. The CONTRACTOR shall not perform any paving prior to this conference.

53.13 Rock Excavation: All excavations for the installation of pipes, structures, foundations, or other contract items shall be unclassified and no additional or separate payment for rock excavation shall be provided nor shall additional or separate payment be made for backfill required to compensate for excavated rock material that cannot be reused as backfill.

### 53.14 Permits

53.14.1 Copies of permits for this project other than for dewatering or NPDES

will be provided by the COUNTY.

53.14.2 The CONTRACTOR shall abide by all conditions, statutes, and regulations issued by the jurisdiction authorities, boards and agencies of the COUNTY, State and Federal Governments. The CONTRACTOR shall be fully responsible for the execution and adherence to all directives, instructions, conditions, issuance of notices, special conditions, and limiting conditions contained in permits specifically issued for this project and which pertain to or affect the construction phase of this project. Except as may be provided elsewhere in these documents, the cost of materials, supplies, labor testing, permit fees and other direct or indirect expenses required to abide by or execute conditions of the permits shall be paid for by the CONTRACTOR. There is no direct or specific payment item in the bid for cost due to compliance with said permits. The CONTRACTOR'S reimbursement for said costs shall be distributed within the various items of work and materials associated with the construction of the project.

53.15 Field Office: CONTRACTOR is not required to provide a field office within the project limits as long as CONTRACTOR has a field office within Lee, Collier or Charlotte County prior to bidding. If CONTRACTOR does not have an established office within Lee, Collier or Charlotte County, then the CONTRACTOR shall provide and staff a field office within the project limits for the entire project duration, per Utilities requirements. This item shall be compensated under the mobilization item and no separate payment will be made. The CONTRACTOR shall coordinate the location of this field office with the Lee County Project Manager prior to the issuance of the Notice to Proceed.

#### **54 Computation of Time**

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

#### **55 Maintenance of Records**

55.1 The CONTRACTOR shall keep adequate records and supporting documents applicable to this contractual matter. Said records and documentation will be retained by the CONTRACTOR for a minimum of five years from the date of termination of this Contract. The COUNTY and its authorized agents shall have the right to audit, inspect and copy records and documentation as often as the COUNTY deems necessary during the period of this Contract and during the period of five years thereafter; provided, however, such activity shall be conducted only during normal business hours. The COUNTY, during the period of time expressed by the preceding sentence, shall also have the right to obtain a

copy of, and otherwise inspect, any audit made at the direction of the CONTRACTOR as concerns the aforesaid records and documentation.

55.2 Vendor specifically acknowledges its obligations to comply with §119.0701, F.S., with regard to public records, and shall:

55.2.1 keep and maintain public records that ordinarily and necessarily would be required by the COUNTY in order to perform the services required under this Agreement;

55.2.2 provide the public with access to public records on the same terms and conditions that the COUNTY would provide the records and at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes, or as otherwise provided by law;

55.2.3 ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed, except as authorized by law; and

55.2.4 meet all requirements for retaining public records and transfer, at no cost to the COUNTY, all public records in possession of CONTRACTOR upon termination of this Agreement and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the COUNTY in a format that is compatible with the information technology system of the COUNTY.

55.3 **IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THE CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT 239-533-2221, 2115 SECOND STREET, FORT MYERS, FL 33901, <http://www.leegov.com/publicrecords>.**

## 56 Federal Requirements

56.1 In the event this Contract is paid in whole or in part from any Federal Governmental agency or source, the specific terms, regulations and requirements governing the disbursement of these funds are incorporated by reference and made a part of this Contract as if attached hereto and become a part of this clause.

## **SCOPE OF WORK AND SPECIFICATIONS**

1. Lee County Utilities Specifications Package

End of Scope of Work and Specifications Section





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## **LEE COUNTY UTILITIES**

*Construction of*

### **NORTH LEE COUNTY WATER TREATMENT PLANT RO CONCENTRATE ACID FEED SYSTEM**

*Technical Specifications – 100% Submittal*

December 2016



Certificate No. 8571



**LEE COUNTY UTILITIES  
NORTH LEE COUNTY WATER TREATMENT PLANT  
RO CONCENTRATE ACID FEED SYSTEM**

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## SECTION 01\_11\_00

### SUMMARY OF WORK

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Identification and summary description of the Project, the Work, location, OWNER assigned subcontractors, activities by others, coordination, and early occupancy by OWNER.
- B. Related sections:
  - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

##### 1.02 THE WORK

- A. The Work consists of modifications to the sulfuric acid feed system at the North Lee County Water Treatment Plant (NLC WTP) that was summarized in the report titled: NORTH LEE COUNTY WATER TREATMENT PLANT INJECTION WELL SYSTEM SCALING EVALUATION, April 2016, prepared by Carollo Engineers. The following project elements are included in the Work:
  - 1. Installation of new sulfuric acid metering pump skid to provide appropriate chemical dosing.
  - 2. Replacement of sulfuric acid conveyance piping and tubing to appropriate size.
  - 3. Replacement of the existing sulfuric acid day tank and radar type level sensor/transmitter.
  - 4. Abandonment and removal of existing sulfuric acid piping, mass flow meter, and appurtenances, as specified.
  - 5. PLC programming and control interface modifications.
- B. Except as specifically noted otherwise, provide and pay for:
  - 1. Insurance and bonds.
  - 2. Labor, materials, and equipment.
  - 3. Tools, equipment, and machinery required for construction.
  - 4. Other facilities and services necessary for proper execution and completion of the Work, including draining chemical lines, appropriate safety measures and chemical (i.e., sulfuric acid) waste disposal.
- C. Comply with codes, ordinances, regulations, orders, and other legal requirements of public authorities having bearing on the performance of the Work.

##### 1.03 LOCATION OF PROJECT

- A. The Work is located in Lee County, Florida at 18250 Durrance Road, Fort Myers, Florida 33917.

#### **1.04 OWNER ASSIGNED SUBCONTRACTORS**

- A. PLC programming and control interface modifications shall be performed by one of the following:
  - 1. BCI Technologies, Fort Myers, FL  
Phone: 239-443-9600

#### **1.05 ACTIVITIES BY OTHERS**

- A. OWNER, utilities, and others may perform activities within Project area while the Work is in progress.
  - 1. Schedule the Work with OWNER, utilities, and others to minimize mutual interference.
- B. Activities by others which may affect performance of work include:
  - 1. Chemical deliveries as directed by OWNER's staff.
  - 2. No other construction is planned for the duration of the project.
- C. Cooperate with others to minimize interference and delays.
  - 1. When cooperation fails, submit recommendations and perform Work in coordination with work of others.
- D. When the Work depends on proper execution or results depend upon work performed by others, inspect and promptly report apparent discrepancies or defects in work performed by others.
  - 1. Assume responsibility for work performed by others, except for defects reported as specified in this paragraph and defects which may become apparent in work performed by others after execution of the Work.

#### **1.06 COORDINATION OF WORK**

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.

#### **1.07 EARLY OCCUPANCY OF PORTIONS OF WORK**

- A. To keep the treatment plant operating, under the control of the OWNER's licensed operations staff, OWNER's utilization of portions of the work prior and following substantial completion is anticipated.
- B. After OWNER occupancy, allow access for OWNER's personnel, access for others authorized by OWNER, and OWNER operation of equipment and systems.
- C. Following occupancy, OWNER will:
  - 1. Repair damage caused by OWNER's occupancy.



**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

END OF SECTION



## SECTION 01\_14\_00

### WORK RESTRICTIONS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Requirements for sequencing and scheduling the Work affected by existing site and facility, work restrictions, and coordination between construction operations and plant operations, including:
  - 1. Access to site.
  - 2. Use of site.
  - 3. Use of premises.
  
- B. Related sections:
  - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
  - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
  - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.

##### 1.02 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

- A. The North Lee County Water Treatment Plant (NLC WTP) is an important part of the OWNER's drinking water supply:
  - 1. Conduct work such that the OWNER's ability to meet its customer's demands for treated drinking water shall not be impaired or reduced in terms of the required quantity or quality of treated water. Do not impair the operational capabilities of essential elements of the treatment process or reduce treatment capacity below levels sufficient to meet demands for water throughout the contract time. The quantities of and quality of treated water required are described in this Section.
  - 2. The status of the treatment plant shall be defined as "operational" when the plant is capable of meeting the OWNER's customer's demands for treated drinking water in terms of the required quantity or quality of treated water as defined in this Section.
  
- B. Work sequence and constraints:
  - 1. The CONTRACTOR shall schedule work to meet the substantial and final completion deadlines identified in the Contract Documents.
  - 2. Utilize description of critical events in the Contract Documents as a guideline for scheduling and undertaking the Work.
  - 3. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities.

### 1.03 INTERRUPTION OF TREATMENT PROCESSES

- A. Execute the Work while the existing facility is in operation as specified.
- B. Indicate required shutdowns of existing facilities or interruptions of existing operations on Progress Schedule. Shutdowns will be permitted to the extent that existing operation of the plant will not be jeopardized and identified constraints are satisfied.
- C. Submit notification of required shutdowns of existing facilities at least 7 days prior to the planned date of shutdown.
- D. The OWNER will evaluate the request based on the plant's ability to reliably meet capacity demands.
- E. Do not begin alterations until OWNER's written permission has been received.
- F. Minimize shutdown times by thorough advanced planning. Have required equipment, materials, and labor on hand at time of shutdown.
- G. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.

### 1.04 COMPLIANCE WITH FACILITY OPERATING PERMITS

- A. Drinking Water Permit
  - 1. The NLC WTP is operating under the terms of an operating permit issued by the Lee County Department of Health. This permit specifies the water quality limits that the plant must meet prior to discharge of finished water.
  - 2. Perform work in a manner that will not prevent the existing facility from achieving the finished water quality requirements established by regulations.
  - 3. Bear the cost of penalties imposed on the OWNER for water quality violations caused by actions of the CONTRACTOR.
- B. Class I Injection Well Permit
  - 1. The NLC WTP operates a Class I Deep Injection Well, permitted for operation by FDEP, that is used for the disposal of membrane concentrate. Membrane concentrate is the only permitted fluid allowed for disposal using this injection well. The OWNER operates a 4.04 million gallon brine disposal pond to equalize concentrate flows from the treatment plant to the injection well and maintain an injection flow rate and pressure less than or equal to the permitted limit.
    - a. Permit limits for flow and pressure:
      - 1) Injection into the well shall not exceed 3,509 gallons per minute (5.05 MGD) and injection pressure as measured at the well head shall not exceed 103 psig.
  - 2. Variances for alternate discharge fluids:
    - a. Variances may be received, allowing the disposal of other fluids, including hydrostatic test, disinfection test and off-spec testing waters. Written requests for variances should be submitted by the OWNER to FDEP should they be needed by the CONTRACTOR. CONTRACTOR shall

- notify OWNER at least 10 days prior to the planned discharge event to request the injection well disposal fluid variance.
- b. When CONTRACTOR is requesting a variance for test fluid disposal, the brine pond may be used for flow equalization, if agreeable to the OWNER.

## **1.05 COMPLIANCE WITH OTHER PERMITS AND REGULATORY REQUIREMENTS**

- A. Development Order and Environmental Resources Permit
  1. Comply with requirements of the Site Development Order and Environmental Resources Permit.

## **1.06 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES**

- A. Facilities or conditions required to keep the existing plant operational include, but are not limited to, the following:
  1. Electrical power including transformers, distribution wiring, and motor control centers.
  2. Raw (untreated) water. Existing pipelines are provided for this.
  3. Piping for conveyance of raw, partially treated and finished water between treatment or storage units.
  4. A means of adding chemicals to the raw and finished water.
  5. Chemical storage, metering, conveyance, and control facilities. These are provided with existing storage tanks for sulfuric acid, scale inhibitor, caustic soda, sodium hypochlorite, ammonia, corrosion inhibitor, and hydrofluorosilicic acid; chemical metering pumps; chlorine residual analyzers; pH analyzers, chemical solution piping at various locations in the plant. Plant water is required at all times to permit ammoniation.
    - a. New chemical metering, conveyance, and control facilities will be phased into the existing plant with minimal interruption.
    - b. Continuous addition of chemicals is required during plant operations.
    - c. The ability to continuously apply chlorine following degasification is required.
  6. Reverse osmosis trains: Two (2) reverse osmosis membrane trains are required at all times.
  7. Cartridge Filters.
  8. Scavenger Pumps: One (1) scavenger pump must remain operational at all times to avoid a plant shutdown.
  9. Storage of treated water in the following structures:
    - a. Chlorine contact basin
    - b. Finished water storage tanks
  10. Plant air.
  11. Laboratory facilities.
  12. Office, toilets, and washrooms.
  13. Septic system.
  14. Concentrate disposal: The deep injection well must remain operational with no more than a 3-day shutdown.
  15. Fencing and gates.
  16. Lighting.
  17. Heating, ventilation, and air conditioning.
  18. Instrumentation, meters, controls, and telemetry equipment.
  19. Safety equipment and features.

- 20. Parking for County employees and vehicles required for operation and maintenance of the NLC WTP.
  - 21. Telephone system.
  - 22. Storm drainage.
- B. Conduct the Work and provide temporary facilities required to keep the existing plant continuously operational.
- C. Do not remove or demolish existing facilities required to keep the existing plant operational at the capacities specified until the existing facilities are replaced by temporary, new, or upgraded facilities or equipment. The replacement facilities shall have been tested and demonstrated to be operational prior to removing or demolishing existing facilities.

#### **1.07 OPERATIONS AND MAINTENANCE ACCESS**

- A. Provide safe, continuous access to process control equipment for plant operations personnel.
- B. Provide access on 1-hour advance notice to process control equipment for plant maintenance personnel and associated maintenance equipment.

#### **1.08 UTILITIES**

- A. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.
- B. Contact the following authority before digging to verify location of buried utilities two full days before digging in any easement, right of way or permitted use area:
  - 1. Sunshine State One Call, at 1-800-432-4770,

#### **1.09 COORDINATION OF WORK**

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from subcontractors and suppliers, and assume responsibility for correctness.
- C. Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

#### **1.10 WORK BY OTHERS**

- A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

#### **1.11 WORK SEQUENCE**

- A. Critical Work activities and construction constraints are presented and discussed below. The construction constraints described do not include all activities necessary to complete the Work or the activity described. The construction constraints are intended to show the order and/or nature of critical activities necessary meet the



project requirements and to help define many of the coordination needs with others.

Selected construction constraints are described as follows:

1. Abandon existing sulfuric metering pump skids, mass flow meter, and chemical piping per drawings.
2. Remove existing piping as shown on the Drawings.
3. Install new sulfuric acid metering pump skid.
4. Install new sulfuric acid piping, tubing, and connect to existing injection quill.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

END OF SECTION



## SECTION 01\_29\_73

### SCHEDULE OF VALUES AND APPLICATION FOR PAYMENTS

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Schedule of Values
- B. Application for Payment

##### **1.2 SCHEDULE OF VALUES**

- A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General Conditions.
- B. Format: Utilize a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification section. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR'S overhead and profit.
- C. Revisions: With each Application for Payment revise schedule to list approved Change Orders.

##### **1.3 APPLICATION FOR PAYMENT**

- A. Required Copies: Submit three copies of each application on EJCDC Form No. 1910-8-E (1990) or approved equal. Present required information in typewritten form or on electronic media printout.
- B. Execute certification by signature of authorized officer.
- C. Use data from approved Schedule of Values.
- D. Stored Materials: When payment for materials stored is permitted, submit a separate schedule for Materials Stored showing line item, description, previous value received, value incorporated into the Work and present value.
- E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.

- F. Final Payment: Prepare Application for Final Payment as required in the General Conditions.
- G. Submit an updated construction schedule with each Application for Payment.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

END OF SECTION

## SECTION 01\_31\_19

### PROJECT MEETINGS

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Coordination
- B. Preconstruction Conference
- C. Progress Meetings

##### **1.2 COORDINATION**

- A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Accessory Placement: Place conduits, saddles, boxes, cabinets, sleeves, inserts, foundation bolts, anchors and other like work in floors, roofs, or walls of buildings and structures in conformity with the construction program.

##### **1.3 PRECONSTRUCTION CONFERENCE**

- A. General: Prior to commencement of the Work, in accordance with the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.
- B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, plant personnel and the CONTRACTOR/VENDOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:
  - 1. Submittal procedures
  - 2. Partial Payment procedures
  - 3. Maintenance of Records
  - 4. Schedules, sequences, and maintenance of facility operations
  - 5. Safety and First Aid responsibilities
  - 6. Change Orders and Field Directive Changes
  - 7. Use of site
  - 8. Housekeeping
  - 9. Equipment delivery
- C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR/VENDOR, the OWNER and plant personnel that will be associated with the project. Representatives of regulatory

agencies, subcontractors, and principal suppliers may also attend when appropriate.

- D. Chair and Minutes: The preconstruction conference will be chaired by the Owner who will also arrange for the keeping and distribution of minutes to all attendees.

#### **1.4 PROGRESS MEETINGS**

- A. Meeting Frequency and Format: Schedule progress meetings on at least a monthly basis or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER, and all SUBCONTRACTOR/VENDORS. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR/VENDOR and reviewed by ENGINEER prior to distribution by the CONTRACTOR/VENDOR. Distribute reviewed minutes to attendees within 7 calendar days after each meeting.

### **PART 2 PRODUCTS**

Not Used

### **PART 3 EXECUTION**

Not Used

END OF SECTION



## SECTION 01\_32\_18

### PROGRESS SCHEDULES AND REPORTS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, Contract time adjustments, and payment requests, including the following:
  - 1. Preliminary Schedule.
  - 2. Baseline Schedule.
  - 3. Schedule Updates.
  - 4. Schedule Revisions.
  - 5. Schedule of Values
  - 6. Time Impact Analyses.

##### 1.02 RESPONSIBLE PERSON

- A. Designate, in writing and within 5 calendar days after Notice to Proceed, person responsible for preparation, maintenance, updating, and revision of all schedules.
- B. Qualifications of responsible person:
  - 1. Authority to act on behalf of CONTRACTOR.
  - 2. 5 years verifiable experience in preparation of complex construction schedules for projects of similar value, size, and complexity.
  - 3. Knowledge of critical path method (CPM) scheduling utilizing Primavera Project Planner or SureTrak or Microsoft Project software.

##### 1.03 SCHEDULING FORMAT AND SOFTWARE

- A. Schedule format: Utilize CPM format.
- B. Prepare computerized schedule utilizing Microsoft Project, most current version.

##### 1.04 PRECONSTRUCTION SCHEDULING MEETING

- A. Contractors' Project Manager will conduct Preconstruction Scheduling Meeting with ENGINEER, OWNER, and CONTRACTOR's Superintendent, and scheduler within 7 calendar days after Notice To Proceed. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively.
- B. At the meeting, review scheduling requirements. These include schedule preparation, reporting requirements, updates, revisions, and schedule delay analysis. Present schedule methodology, planned sequence of operations, and proposed activity coding structure.

## 1.05 PREPARATION

- A. Preparation and submittal of Progress Schedule represents CONTRACTOR's intention to execute the Work within specified time and constraints.
- B. CONTRACTOR's bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.
- C. During preparation of the preliminary Progress Schedule, ENGINEER will facilitate CONTRACTOR's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.
- D. Prepare schedule utilizing Precedence Diagramming Method (PDM).
- E. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivide activities by location, stationing, or other sub-element of the Work. Coordinate holidays to be observed with the OWNER and incorporate them into the schedule as non-working days.
- F. Failure to include an activity required for execution of the Work does not excuse CONTRACTOR from completing the Work and portions thereof within specified times and at price specified in Agreement. Contract requirements are not waived by failure of CONTRACTOR to include required schedule constraints, sequences, or milestones in schedule. Contract requirements are not waived by OWNER's acceptance of the schedule. In event of conflict between accepted schedule and Contract requirements, terms of Contract govern at all times, unless requirements are waived in writing by the OWNER.
- G. Reference schedule to working days with beginning of Contract Time as Day "1."
- H. Contract float is for the mutual benefit of both OWNER and CONTRACTOR. Changes to the project that can be accomplished within this available period of float may be made by OWNER without extending the Contract time, by utilizing float. Time extensions will not be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, CONTRACTOR may utilize float to offset delays other than delays caused by OWNER. Mutual use of float can continue until all available float shown by schedule has been utilized by either OWNER or CONTRACTOR, or both. At that time, extensions of the Contract time will be granted by OWNER for valid OWNER-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by CONTRACTOR.
- I. Non-sequestering of float: Pursuant to float sharing requirements of Contract, schedule submittals can be rejected for use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, extended activity durations or imposed dates.
- J. Interim milestone dates, operational constraints. In event there are interim milestone dates and/or operational constraints set forth in Contract, show them on schedule.

Do not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.

#### **1.06 SUBMITTAL OF PROGRESS SCHEDULES**

- A. Submit preliminary and baseline schedule.
- B. Submit, on a monthly basis, updated schedules as specified. Submit final schedule update as specified.
- C. Submit revised schedules and time impact analyses as specified.
- D. Submit schedules in the media and number of copies as follows:
  - 1. 3 sets of the CPM network and/or bar chart (as specified by the OWNER) on D-size sheets. Color-coding to be specified by the OWNER.
  - 2. 3 sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.
  - 3. 2 sets of CPM Schedule data electronic files stored on CD/DVD

#### **1.07 PRELIMINARY SCHEDULE**

- A. Submit Preliminary Schedule within 10 calendar days after Notice To Proceed with Project services. Include a detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.
- B. Meet with OWNER and ENGINEER within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. Submit revised preliminary schedule within 5 calendar days after meeting.
- C. Incorporate unchanged, the Accepted Preliminary Schedule as first 90 calendar days of activity in CONTRACTOR's Baseline Schedule.

#### **1.08 BASELINE SCHEDULE**

- A. No more than 15 calendar days after Notice of Proceed, submit the Baseline Schedule for all Work of the project. Show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.

#### **1.09 NETWORK DETAILS AND GRAPHICAL OUTPUT**

- A. Produce a clear, legible, and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the Work. Produce the network diagram based upon the early start of all activities.
- B. Include for each activity, the description, activity number, estimated duration in working days, total float, and all activity relationship lines.
- C. Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of 1 activity is dependent upon the

start or completion of preceding activities and its completion restricts the start of following activities.

- D. Indicate the critical path for the project.
- E. Delineate the specified contract duration and identify the planned completion of the Work as a milestone. Show the time period between the planned and Contract completion dates, if any, as an activity identified as project float unless a Change Order is issued to officially change the Contract completion date.
- F. Identify system shutdown dates, system tie-in dates, specified interim completion, or milestone dates and contract completion date as milestones.
- G. Include, in addition to construction activities:
  - 1. Submission dates and review periods for major equipment submittals and shoring submittals:
    - a. Allow minimum 3-week review period for all submittals.
  - 2. Any activity by the OWNER or the ENGINEER that may affect progress or required completion dates.
  - 3. Equipment and long-lead material deliveries over 8 weeks.
  - 4. Approvals required by regulatory agencies or other third parties.
- H. Identify the execution of the following:
  - 1. Mobilization.
  - 2. All required submittals and submittal review times showing 10 calendar day duration for such activities and equal amount of time for re-submittal reviews.
  - 3. Equipment and materials procurement/fabrication/delivery.
  - 4. Metal fastenings, framing, structures, and fabrications.
  - 5. Finishes including coating and painting, flooring, ceiling, and wall covering.
  - 6. Process equipment, including identification of ordering lead-time, factory testing and installation.
  - 7. Pumps and drives, including identification of ordering lead time, factory testing and installation.
  - 8. Other mechanical equipment including fans and heating, ventilating, and air conditioning equipment.
  - 9. Piping, fittings and appurtenances, including identification of ordering and fabrication lead time, layout, installation, and testing.
  - 10. Valves, gates, and operators, including identification of order lead time, installation, and testing.
  - 11. Electric transmission, service, and distribution equipment, including identification of ordering lead-time and factory testing.
  - 12. Instrumentation and controls, including identification of ordering lead-time.
  - 13. Preliminary testing of equipment, instrumentation, and controls.
  - 14. Final testing, including preparation time.
  - 15. Substantial completion.
  - 16. Punch list work.
  - 17. Operation and maintenance training.
  - 18. Demobilization.

## **1.10 SCHEDULE OF SHOP DRAWING AND SAMPLE SUBMITTALS**

- A. After Preliminary Schedule has been submitted and accepted by OWNER, submit a list of all shop drawings and sample submittals anticipated in first 30 calendar days after Notice to Proceed using early start dates.
- B. After Baseline Schedule has been submitted and accepted by OWNER, print out and submit list of all shop drawings and sample submittals for all Work using early start dates. This listing will contain all submittals required for the entire Work including those listed above.

## **1.11 REVIEW AND ACCEPTANCE OF SCHEDULES**

- A. OWNER will review Baseline Schedules, Schedule Updates, Schedule Revisions, and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships, and completeness.
- B. OWNER will issue written comments following completion of review of Baseline Schedule within 7 calendar days after receipt. Written comments on review of Schedule Updates and Schedule Revisions and Time Impact Analyses will be returned to CONTRACTOR within 7 calendar days after receipt by OWNER.
- C. Revise and resubmit schedule in accordance with OWNER's comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections. If a meeting is requested, the CONTRACTOR and all major subcontractors must participate in the meeting with ENGINEER. Revise and resubmit schedule within 7 calendar days after meeting.
- D. When schedule reflects OWNER's and CONTRACTOR's agreement of project approach and sequence, schedule will be accepted by OWNER. Use accepted schedule for planning, organizing, and directing the work and for reporting progress.

## **1.12 UPDATING THE SCHEDULE**

- A. Update the schedule on a monthly basis, using a data date as specified by the OWNER.
- B. Should monthly Schedule Update show project completion earlier than current Contract completion date, show early completion time as schedule activity, identified as "Project Float."
- C. Should monthly Schedule Update show project completion later than current Contract completion date, prepare and submit a Schedule Revision.

## **1.13 REVISIONS TO SCHEDULE**

- A. Submit Revised Schedule within 5 calendar days:
  - 1. When delay in completion of any activity or group of activities indicates an overrun of the Contract Time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
  - 2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.

3. When the schedule does not represent the actual progress of activities.
  4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
  5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.
- B. Submit revised schedule and materials as specified under "Submittal of Progress Schedule."
- C. Make revisions on most recently accepted version of schedule.
- D. Create a separate submittal for Schedule Revisions. Do not submit with Schedule Updates.
- E. Schedule revisions will not be reflected in the schedule until after the revision is accepted by the OWNER. This includes Schedule Revisions submitted for the purpose of mitigating a CONTRACTOR-caused project delay (Recovery Schedule).

## **PART 2 PRODUCTS**

Not Used.

## **PART 3 EXECUTION**

Not Used.

END OF SECTION

## SECTION 01\_33\_00

### SUBMITTAL PROCEDURES

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Description of Requirements
- B. Submittal Procedures
- C. Specific Submittal Requirements
- D. Action on Submittals
- E. Repetitive Review

##### **1.2 DESCRIPTION OF REQUIREMENTS**

- A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.
- B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.
- C. Work-Related Submittals:
  - 1. Substitution or "Or Equal" Items:
    - a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.
  - 2. Shop Drawings:
    - a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.
    - b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.



3. Product Data:
  - a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.
4. Samples:
  - a. Includes both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.
  - b. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.
5. Working Drawings:
  - a. When used in the Contract Documents, the term "working drawings" shall be considered to mean the CONTRACTOR'S plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities control systems, forming and falsework for underpinning; temporary by-pass pumping and for such other work as may be required for construction but does not become an integral part of the project.
  - b. Copies of working drawings shall be submitted to the ENGINEER at least fourteen (14) calendar days (unless otherwise specified by the ENGINEER) in advance of the required work.
  - c. Working drawings shall be signed by a registered Professional Engineer currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.
6. Miscellaneous Submittals:
  - a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

### 1.3 SUBMITTAL PROCEDURES

#### A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawings and samples submittals, in duplicate, and in accordance with the General Conditions.
2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

#### B. Coordination:

1. Coordinate preparation and processing of submittals with performance of work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.
2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

#### C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.
2. Transmittal Form: In the transmittal form forwarding each specific submittal to the ENGINEER include the following information as a minimum.
  - a. Date of submittal and dates of previous submittals containing the same material.
  - b. Project title and number.
  - c. Submittal and transmittal number.
  - d. Contract identification.
  - e. Names of:
    - (1) Contractor
    - (2) Supplier
    - (3) Manufacturer

- f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.
- g. Variations from Contract Documents and any limitations which may impact the Work.
- h. Drawing sheet and detail number as appropriate.

D. Resubmittal Preparation:

- 1. Comply with the requirements described in Submittal Preparation. In addition:
  - a. Identify on transmittal form that submittal is a resubmission.
  - b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.
  - c. Respond to ENGINEER's notations:
    - (1) On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.
    - (2) Identify each response by question or notation number established by ENGINEER.
    - (3) If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.
  - d. CONTRACTOR initiated revisions or variations:
    - (1) On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.
    - (2) ENGINEER's responsibility for variations or revisions is established in the General Conditions.

#### 1.4 SPECIFIC SUBMITTAL REQUIREMENTS

- A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.

B. Requests for Substitution or "Or Equal"

1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with the General Conditions.
2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.
3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.

C. Shop Drawings:

1. Check all drawings, data and samples before submitting to the ENGINEER for review. Each and every copy of the drawings and data shall bear CONTRACTOR's stamp showing that they have been so checked. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR for conformance with this requirement. All shop drawings shall be submitted through the CONTRACTOR, including those from any subcontractors.
2. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier (firm name). Show dimensions and clearly note which are based on field measurement; identify materials and products which are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.
3. Include on each drawing or page:
  - a. Submittal date and revision dates.
  - b. Project name, division number and descriptions.
  - c. Detailed specifications section number and page number.
  - d. Identification of equipment, product, or material.
  - e. Name of CONTRACTOR and Subcontractor.
  - f. Name of Supplier and Manufacturer.
  - g. Relation to adjacent structure or material.

- h. Field dimensions, clearly identified.
  - i. Standards or Industry Specification references.
  - j. Identification of deviations from the Contract Documents.
  - k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
  - l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.
4. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.
5. Submittals:
- a. Submit 3 blue line or black line prints, or 2 reverse sepia reproducible and 1 blue or black line print. One reproducible or one print will be returned.
6. Distribution:
- a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.
  - b. Maintain one set of product data (for each submittal) at Project site.
  - c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER's records.

D. Product Data:

1. Preparation:
- a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, mark copies to clearly show such information is not applicable.
  - b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.
2. Submittals:

a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

b. Submit 3 copies.

3. Distribution:

a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.

b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.

c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER records.

E. Samples:

1. Preparation:

a. Where possible, provide samples that are physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3 units) showing approximate limits of variations.

b. Provide full set of optional samples where ENGINEER's selection required. Prepare samples to match ENGINEER's selection where so indicated.

c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.

d. Submit samples for ENGINEER's visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of work.

2. Submittals:

a. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.

- b. A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.
      - c. Final Submittals: Submit 3 sets of samples in final submittal, 1 set will be returned.
    - 3. Distribution:
      - a. Maintain returned final set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.
      - b. Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections, and shall be in undamaged condition at time of use.
- F. Mock-Ups:
  - 1. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible. Process transmittal forms to provide record of activity.
- G. Miscellaneous Submittals:
  - 1. Inspection and Test Reports:
    - a. Classify each inspection and test report as being either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.
  - 2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:
    - a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
    - b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.
  - 3. Survey Data:



- a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.

- (1) Survey Copies: Furnish 2 copies. Provide 10 copies of final property survey (if any).

- (2) Condition Surveys: Furnish 2 copies.

4. Certifications:

- a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 7 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".

5. Closeout Submittals:

- a. Refer to Specification Section 01\_77\_00 for specific requirements on submittal of closeout information, materials, tools, and similar items.

- (1) Record Documents: Section 01\_77\_00.

- (2) Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

- (3) Operating and maintenance data.

H. Operation and Maintenance Manuals:

- 1. Submit Operation and Maintenance Manuals in accordance with Section 01\_78\_23.

I. General Distribution:

- 1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

## 1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

- 1. General:

- a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.
- b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

- a. Final Unrestricted Release: Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

- a. When submittals are marked "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL AND WITH Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.

3. Comments Attached - Confirm or Resubmit:

- a. When submittals are marked "Examined and Returned for Correction", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.
- b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

## 1.6 RE-SUBMITTAL REVIEW

- A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.

- B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

**PART 2 PRODUCTS**

Not Used

**PART 3 EXECUTION**

Not Used

END OF SECTION



## SECTION 01\_35\_44

### HAZARDOUS MATERIAL PROCEDURES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Procedures required when encountering hazardous materials at the Work site.

##### 1.02 REFERENCES

- A. United States Code of Federal Regulation (CFR), Title 29 and Title 40.
  - 1. 29 CFR 1910.1000.
  - 2. 29 CFR 1910.134.
- B. Steel Structure Painting Council:
  - 1. Guide 61 - Guide for Containing Debris Generated During Paint Removal Operations.
  - 2. Guide 61 - Description of Methods and Systems.
  - 3. Guide 71 - Guide for the Disposal of Lead-Contamination Surface Preparation Debris.
  - 4. PA Guide 3.

##### 1.03 SUBMITTALS

- A. Submit laboratory reports, hazardous material removal plans, and certifications.

##### 1.04 HAZARDOUS MATERIALS PROCEDURES

- A. Hazardous materials are those defined by state and local regulations.
- B. When Hazardous Materials Have Been Found:
  - 1. Prepare and initiate implementation of plan of action.
  - 2. Notify immediately OWNER, ENGINEER, and other affected persons.
  - 3. Notify such agencies as are required to be notified by Laws and Regulations with the times stipulated by such Laws and Regulations.
  - 4. Designate a Certified Industrial Hygienist to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
  - 5. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with laws and regulations.
- C. Forward to ENGINEER, copies of reports, permits, receipts, and other documentation related to remedial work.
- D. Assume responsibility for worker health and safety, including health and safety of Subcontractors and their workers.

1. Instruct workers on recognition and reporting of materials that may be hazardous.
- E. File requests for adjustments to Contract Times and Contract Price due to the finding of Hazardous Materials in the Work site in accordance with the General Conditions.
1. Minimize delays by continuing performance of the Work in areas not affected by hazardous materials operations.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

END OF SECTION

## SECTION 01\_60\_00

### PRODUCT REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Product requirements; product selection; products schedule; execution; manufacturer's instructions; and delivery, handling, and storage.

##### 1.02 DEFINITIONS

- A. Execution: Inclusive of performance, workmanship, installation, erection, application, field fabrication, field quality control, and protection of installed products.
- B. Products: Inclusive of material, equipment, systems, shop fabrications, mixing, source quality control.

##### 1.03 PRODUCT REQUIREMENTS

- A. Comply with Specifications and referenced standards as minimum requirements.
- B. Provide products by same manufacturer when products are of similar nature, unless otherwise specified.
- C. Provide identical products when products are required in quantity.
- D. Provide products with interchangeable parts whenever possible.
- E. Require each equipment manufacturer to have maintenance facilities meeting the following requirements:
  - 1. Minimum 3 years operational experience.
  - 2. Location in continental United States.
  - 3. Equipment and tools capable of making repairs.
  - 4. Staff qualified to make repairs.
  - 5. Inventory of maintenance spare parts.

##### 1.04 PRODUCT SELECTION

- A. When products are specified by standard or specification designations of technical societies, organizations, or associations only, provide products which meet or exceed reference standard and Specifications.
- B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide:
  - 1. Products by 1 of named manufacturers which meets or exceeds Specifications.
  - 2. Accepted or equal.



- C. When products are specified with names of manufacturers and model numbers or catalog designations, provide:
  - 1. Products with model numbers or catalog designations by 1 of named manufacturers.
  - 2. Accepted or equal.
  
- D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by 1 manufacturer only, provide:
  - 1. Products specified by brand or trade name, model number, or catalog designation.
  - 2. Products by 1 of named manufacturers proven in accordance with requirements for or equals to meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.
  - 3. Accepted or equal.
  
- E. When Products are specified with only 1 manufacturer followed by "or Equal," provide:
  - 1. Products meeting or exceeding Specifications by specified manufacturer.
  - 2. Accepted or equal.

#### **1.05 PRODUCT OPTIONS AND SUBSTITUTIONS**

- A. General: Whenever a product is specified using a name of a particular manufacturer or supplier, the specific item cited shall be understood as establishing type, function, dimension, appearance, and quality desired. Other manufacturer's products will be considered for acceptance provided sufficient information is submitted to the ENGINEER for review to determine that the products proposed are equivalent to those named.

#### **1.06 QUALITY ASSURANCE**

- A. Employ entities that meet or exceed specified qualifications, to execute the Work.
- B. Inspect conditions before executing subsequent portions of the Work. Accept responsibility for correcting unsatisfactory conditions upon executing subsequent portions of the Work.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

#### **1.07 DELIVERY, HANDLING, AND STORAGE**

- A. Prepare products for shipment by:
  - 1. Applying grease and lubricating oil to bearings and similar items.
  - 2. Separately packing or otherwise suitably protecting bearings.
  - 3. Tagging or marking products to agree with delivery schedule or shop drawings.
  - 4. Including complete packing lists and bills of material with each shipment.
  - 5. Packaging products to facilitate handling and protection against damage during transit, handling, and storage.

- B. Transport products by methods that avoids product damage. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.
- C. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- D. Upon delivery, promptly inspect shipments. Verify compliance with Contract Documents, correct quantities, and undamaged condition of products. Immediately store and protect products and materials until installed in Work.
- E. Store products with seals and legible labels intact.
- F. Store moisture sensitive products in weathertight enclosures.
- G. Maintain products within temperature and humidity ranges required or recommended by manufacturer.
- H. Connect and operate space heaters during storage when ambient temperatures fall below temperatures recommended by manufacturer.
- I. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces.
- J. Exterior storage of fabricated products:
  - 1. Place on aboveground supports which allow for drainage.
  - 2. Cover products subject to deterioration with impervious sheet covering.
  - 3. Provide ventilation to prevent condensation under covering.
- K. Store loose granular materials on solid surfaces in well-drained area. Prevent materials mixing with foreign matter.
- L. Provide access for inspection.
- M. Maintain equipment per the manufacturer's recommendation and industry standards, including oil changes, rotation, etc. Provide a log of equipment maintenance to the ENGINEER on a monthly basis.

#### **1.08 MANUFACTURER'S INSTRUCTIONS**

- A. Deliver, handle, store, install, erect, or apply products in accordance with manufacturer's instructions, Contract Documents, and industry standards.
- B. Periodically inspect to assure products are undamaged and maintained under required conditions.

#### **PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

END OF SECTION

## SECTION 01\_75\_17

### COMMISSIONING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Requirements for equipment and system testing and facility start-up, including the following:
  - 1. Start-up plan.
  - 2. General start-up and testing procedures.
  - 3. Functional testing.
  - 4. Operational testing.
  - 5. Certificate of proper installation.
  - 6. Services of manufacturer's representatives.
  - 7. Training of OWNER's personnel.
  
- B. Related sections:
  - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
  - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
  - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
    - a. Section 40\_05\_00.09 - Piping Systems Testing
    - b. Section 40\_90\_00 – Process Instrumentation and Controls, General Provisions.
    - c. Section 43\_33\_20.01 - Chemical Pumps

##### 1.02 GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

- A. Contract requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.
  
- B. Complete testing, training, and start-up within the Contract Times.
  
- C. Allow realistic durations in the Progress Schedule for testing, training, and start-up activities.
  
- D. Furnish labor, tools, equipment, instruments, and services required for and incidental to completing functional and performance testing.
  
- E. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

### **1.03 START-UP PLAN**

- A. Submit start-up plan for each piece of equipment and each system not less than 3 weeks prior to planned initial start-up of equipment or system.
- B. Provide detailed sub-network of Progress Schedule with the following activities identified:
  - 1. Manufacturer's services.
  - 2. Operator training.
  - 3. Submission of Operation and Maintenance Manual.
  - 4. Functional testing.
  - 5. Performance testing.
- C. Provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.
- D. Provide summary of shutdown requirements for existing systems which are necessary to complete start-up of new equipment and systems.
- E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

### **1.04 SOURCE QUALITY CONTROL TESTING**

- A. Test equipment for proper performance at point of manufacture or assembly when specified.
- B. When source quality control testing is specified:
  - 1. Demonstrate equipment meets specified performance requirements.
  - 2. Provide certified copies of test results.
  - 3. Do not ship equipment until certified copies have received written acceptance from ENGINEER. Written acceptance does not constitute final acceptance.
  - 4. Perform testing as specified in the equipment sections.

### **1.05 GENERAL START-UP AND TESTING PROCEDURES**

- A. Mechanical systems: As specified in Contract Documents.
  - 1. Remove rust preventatives and oils applied to protect equipment during construction.
  - 2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
  - 3. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.
  - 4. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
  - 5. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
  - 6. Perform cold alignment and hot alignment to manufacturer's tolerances.
  - 7. Adjust V-belt tension and variable pitch sheaves.
  - 8. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.

9. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
  10. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.
- B. Electrical systems: As specified in the individual equipment Sections:
1. Perform insulation resistance tests on wiring except 120 volt lighting, wiring, and control wiring inside electrical panels.
  2. Perform continuity tests on grounding systems.
  3. Test and set switchgear and circuit breaker relays for proper operation.
  4. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.
  5. Check motors for actual full load amperage draw. Compare to nameplate value.
- C. Instrumentation systems: As specified in Section 40\_90\_00 and the individual equipment Sections:
1. Bench or field calibrate instruments and make required adjustments and control point settings.
  2. Leak test pneumatic controls and instrument air piping.
  3. Energize transmitting and control signal systems, verify proper operation, ranges, and settings.

## **1.06 FUNCTIONAL TESTING**

- A. Perform checkout and performance testing as specified in the individual equipment Sections.
- B. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed. Rectify the occurrence of any nuisance alarms.
- C. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.
- D. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation, and other equipment functions.

## **1.07 CERTIFICATE OF PROPER INSTALLATION**

- A. At completion of Functional Testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:
  1. Has been properly installed, adjusted, aligned, and lubricated.
  2. Is free of any stresses imposed by connecting piping or anchor bolts.
  3. Is suitable for satisfactory full-time operation under full load conditions.
  4. Operates within the allowable limits for vibration.
  5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
  6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.

- B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:
  1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
  2. Control logic for equipment start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
  3. Co-sign the reports along with the manufacturer's representative and subcontractors.

**1.08 TRAINING OF OWNER'S PERSONNEL**

- A. Provide operations and maintenance training for items of mechanical, electrical, and instrumentation equipment. Utilize experienced representatives to conduct training sessions.
- B. Coordinate training sessions to prevent overlapping sessions.
- C. Training Manuals
  1. Provide Operation and Maintenance Manual for specific pieces of equipment or systems 1 month prior to training session for that piece of equipment or system.
  2. For Control System Training Manuals
    - a. Training manual shall be provided with color graphics.
    - b. The training manual shall provide detailed working knowledge of the control of the plant and how to use the SCADA interface.
    - c. Each SCADA control object, whether it be a display field, push button, set point field shall be specifically called out in the training manual, and it's purpose explained.
    - d. The underlying theory of why something is controlled shall be explicitly explained in the training manual.
    - e. All faults and permissives that affect the operation of equipment shall be explicitly called out in the training manual.
    - f. All set points shall be recorded in the training manual under a separate section titled "Set Points." An explanation of how the set point value was determined shall also be included with the set point.
- D. Satisfactorily complete functional testing before beginning operator training.
- E. Provide training sessions for each work shift during the times that shall be coordinated by the OWNER for either general mechanical training or for instrumentation/control training. Pooling of shifts will not be permitted unless accepted by OWNER.
- F. Training sessions: Provide training sessions for equipment as specified in the individual equipment Sections.

Section Number	Section title	O&M Manual Required	Minimum Number of Days for Actual Training
43_33_20.01	Chemical Pumps	X	2



- G. The CONTRACTOR shall videotape all training sessions and provide a copy on CD for the OWNER.
- H. The CONTRACTOR shall designate and provide 1 or more persons to be responsible for coordinating and expediting his/her training duties. The person or persons so designated shall be present at all training coordination meetings with the OWNER.
- I. The CONTRACTOR'S coordinator shall coordinate the training periods with OWNER personnel and manufacturer's representatives, and shall submit a training schedule for each piece of equipment or system for which training is to be provided. Such training schedule shall be submitted not less than 14 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

### **1.09 RECORD KEEPING**

- A. Maintain and submit following records generated during start-up and testing phase of Project:
  - 1. Daily logs of equipment testing identifying all tests conducted and outcome.
  - 2. Logs of time spent by manufacturer's representatives performing services on the job site.
  - 3. Equipment lubrication records.
  - 4. Electrical phase, voltage, and amperage measurements.
  - 5. Insulation resistance measurements.
  - 6. Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints.

### **PART 2 PRODUCTS**

Not Used.

### **PART 3 EXECUTION**

Not Used.

END OF SECTION



## SECTION 01\_77\_00

### CLOSEOUT PROCEDURES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Contract closeout requirements including:
  - 1. Final cleaning.
  - 2. Waste disposal.
  - 3. Touch-up and repair.
  - 4. Disinfection of systems.
  - 5. Preparation and submittal of closeout documents.
  - 6. Final completion certification.
  
- B. Related sections:
  - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
  - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
  - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
    - a. N/A

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA).

##### 1.03 FINAL CLEANING

- A. Perform final cleaning prior to inspections for Final Acceptance.
- B. Employ skilled workers who are experienced in cleaning operations.
- C. Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned.
- D. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
- E. Broom clean exterior paved surfaces and rake clean other surfaces of site work:
  - 1. Police yards and grounds to keep clean.
- F. Remove dust, cobwebs, and traces of insects and dirt.
- G. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.

- H. Remove non-permanent protection and labels.
- I. Polish glossy surfaces to clear shine.
- J. Clean permanent filters and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.
- K. Clean ducts, blowers and coils when units were operated without filters during construction.
- L. Clean light fixtures and replace burned-out or dim lamps.

#### **1.04 WASTE DISPOSAL**

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site:
  - 1. Prior to making disposal on private property, obtain written permission from OWNER of such property.
- B. Do not fill ditches, washes, or drainage ways which may create drainage problems.
- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to final acceptance of the Work.

#### **1.05 TOUCH-UP AND REPAIR**

- A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Final Acceptance.
- B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

#### **1.06 FINAL CLEANING AND DISINFECTION OF SYSTEMS OF PLANT FACILITIES**

- A. Wash, wherever practicable, or broom sweep channels, pipe, basins, reservoirs, and tanks.
- B. Provide ample sampling outlets in pipe for testing.

#### **1.07 NOT USED**

#### **1.08 CLOSEOUT DOCUMENTS**

- A. Submit following Closeout Submittals at least 7 days prior to submitting Application for Final Payment:
  - 1. Project Record Documents.
  - 2. Operation and Maintenance Manuals.
  - 3. Warranties and Bonds.
  - 4. Evidence of Payment and Release of Liens.
  - 5. Release of claims as outlined in Conditions of the Contract.

## 1.09 NOTE USED

## 1.10 PROJECT RECORD DOCUMENTS

- A. Maintain at Project site, available to OWNER and ENGINEER, 1 copy of the Contract Documents, shop drawings, and other submittals in good order:
1. Mark and record field changes and detailed information contained in submittals and change orders.
  2. Record actual depths, horizontal and vertical location of underground pipes, duct banks, and other buried utilities. Reference dimensions to permanent surface features.
  3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
  4. Identify location of spare conduits including beginning, ending, and routing through pull boxes and manholes. Record spare conductors, including number and size, within spare conduits and filled conduits.
  5. Provide schedules, lists, layout drawings, and wiring diagrams.
  6. Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

- B. Maintain documents separate from those used for construction:
1. Label documents "RECORD DOCUMENTS."
- C. Keep documents current:
1. Record required information at the time the material and equipment is installed and before permanently concealing.
- D. Deliver record documents with transmittal letter containing date, Project title, CONTRACTOR's name and address, list of documents, and signature of CONTRACTOR.
- E. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.
- F. Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plan, and submits AutoCAD compatible diskette copy of the drawings, and other applicable related records to Lee County Utilities.

## 1.11 WARRANTIES AND BONDS

- A. Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.
- B. CONTRACTOR shall issue two copies of a fully executed warranty to the OWNER.

- C. Warranty period on all work performed under this contract shall begin upon issuance of final completion.
- D. Warranty shall include the start and end date of the warranty period.
- E. Warranty shall include the OWNER'S and CONTRACTORS name.
- F. Warranty shall include the following sections:
  - 1. Warranty calls shall be broken into two categories, emergency and non-emergency. Whether the warranty call is emergency or non-emergency shall be dictated by the OWNER.
  - 2. An emergency warranty call shall be responded to within 4 hours of the call, whether during business hours or not. Warranty response is defined as the PLC programmer who did the work, physically coming to the plant to work on the warranty issue.
  - 3. A non-emergency warranty call shall be responded to within 48 hours of the call, whether during business hours or not. Warranty response is defined as the PLC programmer who did the work, physically coming to the plant to work on the warranty issue.
- G. Special provisions for instrumentation and control systems:
  - 1. Warranty period for the control system and associated programming shall be no less than two (2) years.
- H. The warranty shall be a legal and binding document.

#### **1.12 CERTIFICATE OF FINAL COMPLETION**

- A. When functional test has been successfully completed, ENGINEER will certify that new facilities are operationally complete. ENGINEER will submit a list of known items (punch list) still to be completed or corrected prior to contract completion.
- B. List of items to be completed or corrected will be amended as items are resolved by CONTRACTOR.
- C. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.
- D. Upon completion of final inspection, ENGINEER will either prepare a written acceptance of the entire work or advise CONTRACTOR of work not complete. If necessary, inspection procedures will be repeated.

#### **PART 2 PRODUCTS**

Not Used.

#### **PART 3 EXECUTION**

Not Used.

END OF SECTION

## SECTION 01\_78\_23

### OPERATION AND MAINTENANCE DATA

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Preparation and submittal of Operation and Maintenance Manuals.
  - 2. Special provisions for control system O&M manual contents.

##### 1.02 SUBMITTALS

- A. Submit Operation and Maintenance Manuals before field quality control testing and before training of each piece of equipment or system.
- B. Submit 4 hardcopy manuals for each piece of equipment or system.
- C. Submit 2 electronic copy manuals for each piece of equipment or system.
- D. Make manuals available at project site for use by construction personnel and ENGINEER.
- E. Make additions and revisions to the manuals in accordance with ENGINEER's review comments.

##### 1.03 OPERATION AND MAINTENANCE MANUALS

- A. Preparation:
  - 1. Provide hardcopy Operations and Maintenance Manuals in 3-ring binders with rigid covers. Utilize tab sheets to organize information.
  - 2. Provide electronic copy Operations and Maintenance Manuals in PDF Format with electronic PDF bookmarks denoting tabs and tab titles.
- B. Contents of Operation and Maintenance Manuals:
  - 1. Cover page: Equipment name, equipment tag number, project name, OWNER's name, appropriate date.
  - 2. Table of Contents: General description of information provided within each tab section.
  - 3. Lubrication information: Required lubricants and lubrication schedules.
  - 4. Control diagrams:
    - a. Internal and connection wiring, including logic diagrams, wiring diagrams for control panels, ladder logic for computer based systems, and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.
  - 5. Start-up procedures: Recommendations for installation, adjustment, calibration, and troubleshooting.
  - 6. Operating procedures:
    - a. Step-by-step procedures for starting, operating, and stopping equipment under specified modes of operation.

- b. Include safety precautions and emergency operating shutdown instructions.
  7. Preventative maintenance procedures: Recommended steps and schedules for maintaining equipment.
  8. Overhaul instructions: Directions for disassembly, inspection, repair and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.
  9. Parts list: Generic title and identification number of each component part of equipment; include bearing manufacturer, model and ball or roller pass frequencies for every bearing.
  10. Spare parts list: Recommended number of parts to be stored at the site and special storage precautions.
  11. Drawings: Exploded view or plan and section views with detailed callouts.
  12. Provide electrical and instrumentation schematic record drawings.
  13. Source (factory) quality control test results: Provide copies of factory test reports as specified.
  14. Field quality control test results: After field-testing is completed, insert field test reports as specified.
  15. Equipment Summary Form: Completed form in the format attached at the end of this Section. Insert Equipment Summary Form after the tab sheet of each equipment section. The manufacturer's standard form will not be acceptable.
- C. Special Provisions for Control System Manual Contents:
  1. O&M manual shall contain a copy of the most current PLC program with descriptors for each PLC at the plant. The electronic copy of the O&M manual shall contain the actual PLC files and not a PDF version of the actual file.
  2. O&M manual shall contain a copy of the training manual. The electronic copy of the O&M manual shall contain the actual Word document file for the training manual and not a PDF version of the actual file.
  3. O&M manual shall contain a copy of the memory maps from PLC to PLC and all other devices such as MCC's and VFD's. The electronic copy of the O&M manual shall contain the actual Excel file for the IO map and not a PDF version of the actual file.
  4. Electronic copy of the O&M manual shall contain a copy of the most current 3D model files used for the SCADA screens in the native format of the software.
  5. Electronic copy of the O&M manual shall contain a copy of the most current SCADA system project back up. It will also include a back up of any included projects and the "citect.ini" file for the primary, backup, display client automation computers.
  6. The hard and electronic copies of the O&M manuals shall contain any and all other material not explicitly stated here, but of value and importance to the operation and maintenance of the control system.

## **PART 2 PRODUCTS**

Not Used.

## **PART 3 EXECUTION**

Not Used.



EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM \_\_\_\_\_
2. MANUFACTURER \_\_\_\_\_
3. EQUIPMENT IDENTIFICATION NUMBER(S) \_\_\_\_\_  
(maps equipment number)
4. LOCATION OF EQUIPMENT \_\_\_\_\_
5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NAMEPLATE DATA -

Horsepower \_\_\_\_\_  
Amperage \_\_\_\_\_  
Voltage \_\_\_\_\_  
Service Factor (S.F.) \_\_\_\_\_  
Speed \_\_\_\_\_  
ENC Type \_\_\_\_\_  
Capacity \_\_\_\_\_  
Other \_\_\_\_\_

7. MANUFACTURER'S LOCAL REPRESENTATIVE  
Name \_\_\_\_\_  
Address \_\_\_\_\_  
Telephone Number \_\_\_\_\_

8. MAINTENANCE REQUIREMENTS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9. LUBRICANT LIST \_\_\_\_\_  
\_\_\_\_\_

10. SPARE PARTS (recommendations) \_\_\_\_\_  
\_\_\_\_\_

11. COMMENTS \_\_\_\_\_

END OF SECTION



## SECTION 26 05 02

### BASIC ELECTRICAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 RELATED SECTIONS

- A. Requirements specified within this section apply to all sections in Division 26, Electrical. Work specified herein shall be performed as if specified in the individual sections.

##### 1.02 DESIGN REQUIREMENTS

- A. All electronic boards as part of electrical equipment shall meet the atmospheric conditions of the space the equipment is installed in. All electronic boards which are not installed in a conditioned environment shall be fungus-resistant.
- B. All electrical equipment shall be rated for the conditions the equipment is installed in.

##### 1.03 STANDARDS, CODES, PERMITS, AND REGULATIONS

- A. Perform all work; furnish and install all materials and equipment in full accordance with the latest applicable rules, regulations, requirements, and specifications of the following:
  - 1. Local Laws and Ordinances.
  - 2. State and Federal Laws.
  - 3. National Electrical Code (NEC).
  - 4. State Fire Marshal.
  - 5. Underwriters' Laboratories (UL).
  - 6. National Electrical Safety Code (NESC).
  - 7. American National Standards Institute (ANSI).
  - 8. National Electrical Manufacturer's Association (NEMA).
  - 9. National Electrical CONTRACTOR'S Association (NECA) Standard of Installation.
  - 10. Institute of Electrical and Electronics Engineers (IEEE).
  - 11. Insulated Cable Engineers Association (ICEA).
  - 12. Occupational Safety and Health Act (OSHA).
  - 13. National Electrical Testing Association (NETA).
  - 14. American Society for Testing and Materials (ASTM).
  - 15. Florida Building Code, including local County amendments.
- B. Conflicts, if any, which may exist between the above items, will be resolved at the discretion of the ENGINEER.
- C. Wherever the requirements of the Specifications or Drawings exceed those of the above items, the requirements of the Specifications or Drawings govern. Code

compliance is mandatory. Construe nothing in the Contract Documents as permitting work not in compliance with these codes.

- D. Obtain all permits and pay all fees required by any governmental agency having jurisdiction over the work. Arrange all inspections required by these agencies. On completion of the work, furnish satisfactory evidence to the ENGINEER that the work is acceptable to the regulatory authorities having jurisdiction.

#### **1.04 ELECTRICAL COORDINATION**

- A. Work Provided Under this Contract:
  - 1. Provide and install all electrical equipment indicated on the Drawings and described in the specifications complete in place.
  - 2. Provide all necessary electrical work described herein and on the electrical drawings, but not limited to the: replacement/modification of the Sulfuric Acid Feed Control Panel, removal of the Sulfuric Acid Mass Flow Meter, replacement of the existing Sulfuric Acid Day Tank and Radar Type Level Sensor/Transmitter, replacement of the existing Day Tank Isolation Valve with new, replacement of the existing Sulfuric Acid Feed Pumps Skid, removal of the existing Sulfuric Acid Isolation Valves and addition of the new Sulfuric Acid Isolation Valve to Concentrate.
  - 3. Provide all miscellaneous electrical including switches, terminations, fittings, wiring, conduit, junction boxes, etc. not specified but obviously necessary for a complete working system in place.
  - 4. After approval of the instrumentation submittal and most of the package systems, the electrical contractor shall arrange a meeting with the electrical engineer and verify that all power, control and instrumentation signals are present in a designated conduit.

#### **1.05 SUBMITTALS**

- A. Quality Control Submittals:
  - 1. Voltage Field Test Results.
  - 2. Voltage Balance Report.
  - 3. Equipment Line Current Report.
  - 4. Factory test certification and reports for all major electrical equipment.
  - 5. Site test certification and reports as specified in other Division 26, Electrical sections.
  - 6. As part of the electrical submittal, the contractor shall provide a minimum of ¼"=1'-0" scaled layout of the electrical equipment showing sizes of all equipment and their spatial relationship. Non-electrical equipment shall be approved before finalizing the electrical layout in mechanical rooms.
- B. The following information shall be provided for all electrical equipment:
  - 1. A copy of each specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check-marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of

the paragraph not underlined shall signify compliance on the part of the CONTRACTOR with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation.

2. Electrical equipment submittals shall be made by specification section. Submit one package per specification section and do not group multiple specification sections under one submittal package.
3. Provide complete conduit and equipment layouts: a scaled plan layout of the electrical room(s) showing spatial relationships of all equipment as well as the overall size of the room. Minimum scale shall be ¼"=1'-0".
4. Provide a conduit plan for major power, instrumentation and control conduits, both interior and exterior, showing routing, size and stub up locations for buried or in slab conduits.

#### **1.06 ENVIRONMENTAL CONDITIONS**

- A. All chemical rooms and areas shall be designated as corrosive.
- B. All indoor chemical and process equipment areas shall be considered wet locations.
- C. Electrical equipment in rooms designated as Classified by NFPA 70 (national electrical code) as Division 1 or Division 2 shall meet all requirements set forth for that classification as described in NEC article 500.

#### **1.07 INSPECTION OF THE SITE AND EXISTING CONDITIONS**

- A. Verify all scaled dimensions prior to submitting bids.
- B. Before submitting a bid, visit the site and determine conditions at the site and at all existing structures in order to become familiar with all existing conditions and electrical system which will, in any way or manner, affect the work required under this Contract. No subsequent increase in Contract cost will be allowed for additional work required because of the CONTRACTOR's failure to fulfill this requirement.
- C. Carry out any work involving the shutdown of the existing services to any piece of equipment now functioning in existing areas at such time as to provide the least amount of inconvenience to the OWNER. Do such work when directed by the ENGINEER.
- D. After award of Contract, locate all existing underground utilities at each area of construction activity. Protect all existing underground utilities during construction. Pay for all required repairs without increase in Contract cost, should damage to underground utilities occur during construction.

#### **1.08 RESPONSIBILITY**

- A. The CONTRACTOR shall be responsible for:
  1. Complete systems in accordance with the intent of these Contract Documents.
  2. Coordinating the details of facility equipment and construction for all Specification Divisions which affect the work covered under Division 26, Electrical.

3. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
4. Coordinate with equipment supplier for dimensions of the equipment and ask the supplier to ship the equipment in section if the equipment is too large to enter the room (door) where the equipment will be installed. The cost to assemble the equipment at the job site shall be included in the bid price.

## **1.09 INTENT OF DRAWINGS**

- A. Electrical plan Drawings show only general location of equipment, devices, and raceway, unless specifically dimensioned. The CONTRACTOR shall be responsible for the proper routing of raceway, subject to the approval of the ENGINEER.
- B. All electrical equipment sizes and characteristics have been based on manufacturer Eaton (Cutler-Hammer). If the CONTRACTOR chooses to and is allowed to substitute, the CONTRACTOR shall be responsible for fitting all the equipment in the available space as shown on the Drawings.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Provide materials and equipment listed by UL wherever standards have been established by that agency.
- B. Equipment Finish:
  1. Provide manufacturers' standard finish and color, except where specific color is indicated.
  2. If manufacturer has no standard color, provide equipment with ANSI No. 61, light gray color.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.
- B. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

### **3.02 LOAD BALANCE**

- A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.
- B. Balance electrical load between phases as nearly as possible on switchboards, panel boards, motor control centers, and other equipment where balancing is required.

- C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

### **3.03 CHECKOUT AND STARTUP**

- A. Voltage Field Test:
  - 1. Check voltage at point of termination of power company supply system to project when installation is essentially complete and is in operation.
  - 2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
  - 3. Record supply voltage (all three phases simultaneously on the same graph) for 24 hours during normal working day.
    - a. Submit Voltage Field Test Report within 5 days of test.
  - 4. Unbalance Corrections:
    - a. Make written request to power company to correct condition if balance (as defined by NEMA) exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4 percent of nominal.
    - b. Obtain a written certification from a responsible power company official that the voltage variations and unbalance are within their normal standards if corrections are not made.
- B. Equipment Line Current Tests:
  - 1. Check line current in each phase for each piece of equipment.
  - 2. Make line current check after power company has made final adjustments to supply voltage magnitude or balance.
  - 3. If any phase current for any piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.
- C. Startup:
  - 1. Demonstrate satisfactory operation of all 480-volt electrical equipment. Participate with other trades in all startup activities.
  - 2. Assist the Instrumentation and Control (I&C) CONTRACTOR in verifying signal integrity of all control and instrumentation signals.

END OF SECTION





## SECTION 26\_05\_04

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 GENERAL

##### 1.01 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
1. American National Standards Institute (ANSI):
    - a. C55,1, Standard for Shunt Power Capacitors.
    - b. C62.11, Standard for Metal-Oxide Surge Arrestors for AC Circuits.
    - c. Z55.1, Gray Finishes for Industrial Apparatus and Equipment.
  2. American Society for Testing and Materials (ASTM):
    - a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
    - b. A240, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
    - c. A570, Standard Specification for Steel, Sheet, and Strip, Carbon, Hot-Rolled, Structural Quality.
  3. Federal Specifications (FS):
    - a. W-C-596, Connector, Receptacle, Electrical.
    - b. W-S-896E, Switches, Toggle, Flush Mounted.
  4. National Electrical Contractor's Association, Inc. (NECA): 5055, Standard of Installation.
  5. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    - b. AB 1, Molded Case Circuit Breakers and Molded Case Switches.
    - c. CP I, Shunt Capacitors.
    - d. ICS 2, Industrial Control Devices, Controllers, and Assemblies.
    - e. KS 1, Enclosed Switches.
    - f. LA I, Surge Arrestors.
    - g. PB 1, Panelboards.
    - h. ST 20, Dry-Type Transformers for General Applications.
    - i. WD I, General Requirements for Wiring Devices.
  6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC),
  7. Underwriters Laboratories, Inc. (UL):
    - a. 67, Standard for Panelboards.
    - b. 98, Standard for Enclosed and Dead-Front Switches.
    - c. 198C, Standard for Safety High-Interrupting-Capacity Fuses, Current-Limiting Types.
    - d. 198E, Standard for Class Q Fuses.
    - e. 486E, Standard for Equipment Wiring Terminals.
    - f. 489, Standard for Molded Case Circuit Breakers and Circuit Breaker Enclosures.
    - g. 508, Standard for Industrial Control Equipment.
    - h. 810, Standard for Capacitors.
    - i. 943, Standard for Ground-Fault Circuit Interrupters.

- j. 1059, Standard for Terminal Blocks.
- k. 1561, Standard for Dry-Type General-Purpose and Power Transformers.

## **1.02 SUBMITTALS**

- A. Shop Drawings:
  - 1. Device boxes for use in hazardous areas.
  - 2. Junction and pull boxes used at, or below, grade.
  - 3. Hardware.
  - 4. Terminal junction boxes.
  - 5. Panelboards and circuit breaker data.
  - 6. Fuses.
  - 7. Contactors.
  - 8. Transformers.
  - 9. All other miscellaneous material part of this project.
  - 10. Wire pulling compound.
- B. Quality Control Submittals:
  - 1. Test Report: Sound test certification for dry type power transformers (0 to 600-Volt, primary).

## **1.03 QUALITY ASSURANCE**

- A. UL Compliance: Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.
- B. Hazardous Areas: Materials and devices shall be specifically approved for hazardous areas of the class, division, and group shown and of a construction that will ensure safe performance when properly used and maintained.

## **1.04 SPARE PARTS**

- A. Furnish, tag, and box for shipment and storage the following spare parts:
  - 1. Fuses, 0 to 600 Volts: Six of each type and each current rating installed.
- B. One of each size VFD. Not an entire VFD enclosure/assembly, just the actual VFD itself.
- C. One of each type of power surge suppressor
- D. One of each type of light bulb
  - 1. Ten of each type of the following
  - 2. Each type of fuse.
  - 3. Each type of relay
  - 4. Each type of signal surge suppressor
  - 5. Each color Pilot light

## **PART 2 PRODUCTS**

### **2.01 OUTLET AND DEVICE BOXES**

- A. Sheet Steel: One-piece drawn type, zinc- or cadmium-plated.

- B. Cast Metal:
  - 1. Box: Cast ferrous metal.
  - 2. Cover: Gasketed, weatherproof, cast ferrous metal, with stainless steel screws.
  - 3. Hubs: Threaded.
  - 4. Lugs (Cast Mounting) Manufacturer:
    - a. Crouse-Hinds; Type FS or FD.
    - b. Appleton; Type FS or FD.
  
- C. Cast Aluminum:
  - 1. Material:
    - a. Box: Cast, copper-free aluminum.
    - b. Cover: Gasketed, weatherproof, cast copper-free aluminum with stainless steel screws.
  - 2. Hubs: Threaded.
  - 3. Lugs: Cast mounting.
  - 4. Manufacturers:
    - a. Crouse-Hinds; Type FS-SA or FD-SA.
    - b. Appleton; Type FS or FD.
  
- D. PVC-Coated Sheet Steel:
  - 1. Type: One-piece.
  - 2. Material: Zinc- or cadmium-plated.
  - 3. Coating: All surfaces; 40-mil PVC.
  - 4. Manufacturer: Appleton.
  
- E. Nonmetallic:
  - 1. Box: PVC.
  - 2. Cover: PVC, weatherproof, with stainless steel screws.
  - 3. Manufacturer: Carlon; Type FS or FD, with Type E98 or E96 covers.

## **2.02 JUNCTION AND PULL BOXES**

- A. Outlet Boxes Used as Junction or Pull Box: As specified under Article Outlet and Device Boxes.
  
- B. Large Sheet Steel Box: NEMA 250, Type 1.
  - 1. Box: Code-gauge, galvanized steel or painted carbon steel.
  - 2. Cover: Full access, screw type.
  - 3. Machine Screws: Corrosion-resistant.
  
- C. Large Cast Metal Box: NEMA 250, Type 4.
  - 1. Box: Cast malleable iron, hot-dip galvanize finished, with drilled and tapped conduit entrances.
  - 2. Cover: Hinged with screws.
  - 3. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
  - 4. Manufacturers, Surface Mounted Type:
    - a. Crouse-Hinds; Series W.
    - b. O.Z./Gedney; Series Y.
  - 5. Manufacturers, Recessed Type:
    - a. Crouse-Hinds; Type WJBF.
    - b. O.Z./Gedney; Series YR.

- D. Large Stainless Steel Box: NEMA 250, Type 4X.
  - 1. Box: 14-gauge, ASTM A240, Type 316 stainless steel.
  - 2. Cover: Hinged with screws.
  - 3. Hardware and Machine Screws: ASTM A167, Type 3146 stainless steel.
  - 4. Manufacturers:
    - a. Hoffman Engineering Co.
    - b. Robroy Industries.
  
- E. Large Steel Box: NEMA 250, Type 4.
  - 1. Box: 12-gauge steel, with white enamel painted interior and gray primed exterior, over phosphated surfaces, with final ANSI Z55.1, No. 61 gray enamel on exterior surfaces.
  - 2. Cover: Hinged with screws.
  - 3. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
  - 4. Manufacturers:
    - a. Hoffman Engineering Co.
    - b. Robroy Industries.
  
- F. Large Nonmetallic Box:
  - 1. NEMA 250, Type 4X.
  - 2. Box: High-impact, fiberglass-reinforced polyester or engineered thermoplastic, with stability to high heat.
  - 3. Cover: Hinged with screws.
  - 4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
  - 5. Conduit hubs and mounting lugs.
  - 6. Manufacturers:
    - a. Crouse-Hinds; Type NJB.
    - b. Carlon; Series N, C, or H.
    - c. Robroy Industries.
  
- G. Concrete Box:
  - 1. Box: Reinforced, cast concrete.
  - 2. Cover: Cast iron.
  - 3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
  - 4. Manufacturers:
    - a. Brooks Products Inc.; No. 36/36T.
    - b. Qwikset; W 17.

## **2.03 TELEPHONE TERMINAL CABINET (TTC)**

Not Used.

## **2.04 WIRING DEVICES**

- A. Switches:
  - 1. NEMA WD I and FS W-S-896E.
  - 2. Specification grade, totally-enclosed, ac type, with quiet tumbler switches and screw terminals.
  - 3. Capable of controlling 100 percent tungsten filament and fluorescent lamp loads.
  - 4. Rating: 20 amps, 120/277 volts.
  - 5. Color:
    - a. Office Areas: Ivory.

- b. Other Areas: Brown.
  - 6. Switches with Pilot Light: 125-volt, neon light with red jewel, or lighted toggle when switch is ON.
  - 7. Manufacturers:
    - a. Bryant.
    - b. Leviton.
    - c. Hubbell.
    - d. Pass and Seymour.
    - e. Arrow Hart.
  
- B. Receptacle, Single and Duplex:
  - 1. NEMA WD 1 and FS W-C-596.
  - 2. Specification grade, two-pole, three-wire grounding type with screw type wire terminals suitable for No. 10 AWG.
  - 3. High strength, thermoplastic base color.
  - 4. Color:
    - a. Office Areas: Ivory.
    - b. Other Areas: Brown.
  - 5. Contact Arrangement: Contact to be made on two sides of each inserted blade without detent.
  - 6. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps.
  - 7. Manufacturers:
    - a. Bryant.
    - b. Leviton.
    - c. Hubbell.
    - d. Pass and Seymour.
    - e. Sierra.
    - f. Arrow Hart.
  
- C. Receptacle, Ground Fault Circuit Interrupter: Duplex, specification grade, tripping at 5 mA.
  - 1. Color: Ivory.
  - 2. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps, capable of interrupting 5,000 amps without damage.
  - 3. Size: For 2-inch by 4-inch outlet boxes.
  - 4. Standard Model: NEMA WD 1 with No. 12 AWG copper USE/RHH/RHW-XLPE insulated pigtails and provisions for testing.
  - 5. Feed-Through Model: NEMA WD 1, with No. 12 AWG copper USE/RHH/RHW-XLPE insulated pigtails and provisions for testing.
  - 6. Manufacturers:
    - a. Pass and Seymour.
    - b. Bryant.
    - c. Leviton.
    - d. Hubbell.
    - e. Arrow Hart.
  
- D. Receptacle, Special-Purpose:
  - 1. Rating and number of poles as indicated or required for anticipated purpose.
  - 2. Matching plug with cord-grip features for each special-purpose receptacle.
  
- E. Multi outlet Surface Raceway System: Three-wire grounding receptacles, spaced on 6-inch centers with insulated grounding conductor to each receptacle.

1. Color: Gray with black receptacles.
2. Manufacturers:
  - a. Plugmold; 2000.
  - b. Walker; Duct 2GW.

## 2.05 DEVICE PLATES

- A. General: Sectional type plates not permitted.
- B. Plastic:
  1. Material: Specification grade, 0.10-inch minimum thickness, noncombustible, thermosetting.
  2. Color: To match associated wiring device.
  3. Mounting Screw: Oval-head metal, color matched to plate.
- C. Metal:
  1. Material: Specification grade, one-piece, 0.040-inch nominal thickness stainless steel.
  2. Finish: ASTM A167, Type 302/304, satin.
  3. Mounting Screw: Oval-head, finish matched to plate.
- D. Cast Metal:
  1. Material: Malleable ferrous metal, with gaskets.
  2. Screw: Oval-head stainless steel.
- E. Engraved:
  1. Character Height: 3/16 inch.
  2. Filler: Black.
- F. Weatherproof:
  1. For Receptacles: Gasketed, cast metal or stainless steel, with individual cap over each receptacle opening.
  2. Mounting Screw: Stainless steel.
    - a. Cap Spring: Stainless steel.
    - b. Manufacturers:
      - 1) General Electric.
      - 2) Bryant.
      - 3) Hubbell.
      - 4) Sierra.
      - 5) Pass and Seymour.
      - 6) Crouse-Hinds; Type WLRD or WLRS.
      - 7) Bell.
      - 8) Arrow Hart.
  3. For Switches: Gasketed, cast metal incorporating external operator for internal switch.
    - a. Mounting Screw: Stainless steel.
    - b. Manufacturers:
    - c. Crouse-Hinds; DS-181 or DS-185.
    - d. Appleton; FSK-LVTS or FSK-IVS.
- G. Raised Sheet Metal: 1/2-inch high zinc- or cadmium-plated steel designed for one-piece drawn type sheet steel boxes.

## 2.06 LIGHTING AND POWER DISTRIBUTION PANELBOARD (LP, IP, AND PP PANEL)

- A. NEMA PB I, NFPA 70, and UL 67, including panelboards installed in motor control equipment.
- B. Panelboards and Circuit Breakers: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- C. Short-Circuit Current Equipment Rating: Fully rated; series connected unacceptable.
- D. Rating: If not otherwise shown in plans. Applicable to a system with available short-circuit current of 25,000 amperes rms symmetrical at 208Y/120 or 120/240 volts and 65,000 amperes rms symmetrical at 480Y/277 volts.
- E. Where ground fault interrupter circuit breakers are indicated or required by code: 5 mA trip, 10,000 amps interrupting capacity circuit breakers.
- F. Cabinet: As shown on plans.
- G. Bus Bar:
  - 1. Material: Copper, full sized throughout length.
  - 2. Provide for mounting of future circuit breakers along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.
  - 3. Neutral: Insulated, rated 150 percent of phase bus bars with at least one terminal screw for each branch circuit.
  - 4. Ground: Copper, installed on panelboard frame, bonded to box with at least one terminal screw for each circuit.
  - 5. Lugs and Connection Points:
    - a. Suitable for either copper or aluminum conductors.
    - b. Solderless main lugs for main, neutral, and ground bus bars.
    - c. Sub feed or through-feed lugs as shown.
  - 6. Bolt together and rigidly support bus bars and connection straps on molded insulators.
- H. Circuit Breakers:
  - 1. NEMA AB 1 and UL 489.
  - 2. Thermal-magnetic, quick-make, quick-break, molded case, of the indicating type showing ON/OFF and TRIPPED positions of operating handle.
  - 3. Non interchangeable, in accordance with NFPA 70.
  - 4. Locking: Provisions for handle padlocking, unless otherwise shown.
  - 5. Type: Bolt-on circuit breakers in all panelboards.
  - 6. Multi pole circuit breakers designed to automatically open all poles when an overload occurs on one pole.
  - 7. Do not substitute single-pole circuit breakers with handle ties for multi pole breakers.
  - 8. Do not use tandem or dual circuit breakers in normal single-pole spaces.
  - 9. Ground Fault Interrupter:
    - a. Equip with conventional thermal-magnetic trip and ground fault sensor rated to trip in 0.025 second for a 5-milliampere ground fault (UL 943, Class A sensitivity).
    - b. Sensor with same rating as circuit breaker and a push-to-test button.

- I. Manufacturers:
  - 1. Square D.
  - 2. Or approved equal.

## **2.07 MINI-POWER CENTER (MPC)**

- A. General: Transformer, primary and secondary main circuit breakers, and secondary panelboard section enclosed in NEMA 250, Type 4X enclosure. Complete MPC shall be rated for 22,000 amperes RMS symmetrical.
- B. Transformer:
  - 1. Type: Dry, self-cooled, encapsulated.
  - 2. Insulation: Manufacturer's standard, with UL 1561 temperature rise.
  - 3. Full capacity, 2-1/2 percent voltage taps, two above and two below normal voltage.
  - 4. Primary Voltage: See plans.
  - 5. Secondary Voltage: See plans.
- C. Panelboard: Full, UL 489, short-circuit current rated.
  - 1. Type: Thermal-magnetic, quick-make, quick-break, indicating, with noninterchangeable molded case circuit breakers.
  - 2. Number and Breaker Ampere Ratings: Refer to Panel Schedule.

## **2.08 CIRCUIT BREAKER, INDIVIDUAL, 0 TO 600 VOLTS**

- A. NEMA AB I, UL 489 listed for use at location of installation.
- B. Minimum Interrupt Rating: As shown or as required.
- C. Thermal-magnetic, quick-make, quick-break, indicating type, showing ON/OFF and TRIPPED indicating positions of the operating handle.
- D. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- E. Locking: Provisions for padlocking handle.
- F. Multi pole breakers to automatically open all poles when an overload occurs on one-pole.
- G. Enclosure: NEMA 250, Type 12, Industrial Use, 4X - outdoors, wet locations and corrosive areas, unless otherwise shown.
- H. Interlock: Enclosure and switch shall interlock to prevent opening cover with switch in the ON position.
- I. Do not provide single-pole circuit breakers with handle ties where multipole circuit breakers are shown.

## **2.09 FUSED SWITCH, INDIVIDUAL, 0 TO 600 VOLTS**

- A. UL 98 listed for use and location of installation.



- B. NEMA KS 1 and UL 98 Listed for application to system with available short circuit current of 22,000 amps rms symmetrical.
- C. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.
- D. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- E. Fuse mountings shall reject Class H fuses and accept only current-limiting fuses specified.
- F. Enclosure: NEMA 250, Type 12, Industrial Use, 4X - outdoors, wet locations and corrosive areas, unless otherwise shown.
- G. Interlock: Enclosure and switch to prevent opening cover with switch in the ON position.
- H. Manufacturers:
  - 1. General Electric (Preferred).
  - 2. Eaton (Cutler-Hammer).

## **2.10 NONFUSED SWITCH, INDIVIDUAL, 0 TO 600 VOLTS**

- A. NEMA KS 1.
- B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.
- C. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
- D. Enclosure: NEMA 250, Type 12, industrial use, 4X- outdoors, wet locations and corrosive areas, unless otherwise shown.
- E. Interlock: Enclosure and switch to prevent opening cover with switch in the ON position.
- F. Manufacturers:
  - 1. General Electric (Preferred).
  - 2. Eaton (Cutler-Hammer).

## **2.11 FUSE, 0 TO 600 VOLTS**

- A. Current-limiting, with 200,000 ampere rms interrupting rating.
- B. Provide to fit mountings specified with switches and features to reject Class H fuses.
- C. Motor and Transformer Circuits, 0- to 600-Volt:
  - 1. Amperage: 0 to 600.
  - 2. UL 198E, Class RK-1, dual element, with time delay.
  - 3. Manufacturers:
    - a. Bussmann; Type LPS-RK.
    - b. Littlefuse; Type LLS-RK.

- D. Motor and Transformer Circuits, 0- to 250-Volt:
  - 1. Amperage: 0 to 600.
  - 2. UL 198E, Class RK-1, dual element, with time delay.
  - 3. Manufacturers:
    - a. Bussmann; Type LPN-RK.
    - b. Littlefuse; Type LLN-RK.
  
- E. Feeder and Service Circuits, 0- to 600-Volt:
  - 1. Amperage: 0 to 600.
  - 2. UL 198E, Class RK-I, dual element, with time delay.
  - 3. Manufacturers:
    - a. Bussmann; Type LPS-RK.
    - b. Littlefuse; Type LLS-RK.
  
- F. Feeder and Service Circuits, 0- to 250-Volt:
  - 1. Amperage: 0 to 600.
  - 2. UL 198E, Class RK-I, dual element, with time delay.
  - 3. Manufacturers:
    - a. Bussmann; Type LPN-RK.
    - b. Littlefuse; Type LLN-RK.
  
- G. Feeder and Service Circuits, 0- to 600-Volt:
  - 1. Amperage: 601 to 6,000.
  - 2. UL 198C, Class L, double O-rings and silver links.
  - 3. Manufacturers:
    - a. Bussmann; Type KRP-C.
    - b. Littlefuse; Type KLPC.

## **2.12 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCHES**

- A. Contact Rating: NEMA ICS 2, Type A600.
  
- B. Selector Switch Operating Lever: Standard.
  
- C. Indicating Lights: Push-to-test.
  
- D. Pushbutton Color:
  - 1. ON or START: Black.
  - 2. OFF or STOP: Red.
  
- E. Pushbuttons and selector switches lockable in the OFF position where indicated.
  
- F. Legend Plate:
  - 1. Material: Aluminum.
  - 2. Engraving: 11 character/spaces on one line, 14 character/spaces on each of two lines, as required, indicating specific function.
  - 3. Letter Height: 7/64 inch.
  
- G. Manufacturers:
  - 1. Heavy-Duty, Oiltight Type:
    - a. General Electric; Type CR 104P.
    - b. Square D; Type T.
    - c. Cutler-Hammer; Type 10250T.

2. Heavy-Duty, Watertight, and Corrosion-Resistant Type:
  - a. Square D; Type SK.
  - b. General Electric; Type CR 104P.
  - c. Cutler-Hammer; Type E34.
  - d. Crouse-Hinds; Type NCS.

### **2.13 TERMINAL JUNCTION BOX**

- A. Cover: Hinged, unless otherwise shown.
- B. Terminal Blocks: Provide separate connection point for each conductor entering or leaving box.
  1. Spare Terminal Points: 25 percent.
- C. Interior Finish: Paint with white enamel or lacquer.

### **2.14 TERMINAL BLOCK (0 TO 600 VOLTS)**

- A. UL 486E and UL 1059.
- B. Size components to allow insertion of necessary wire sizes.
- C. Capable of termination of all control circuits entering or leaving equipment, panels, or boxes.
- D. Screw clamp compression, dead front barrier type, with current bar providing direct contact with wire between the compression screw and yoke.
- E. Yoke, current bar, and clamping screw of high strength and high conductivity metal.
- F. Yoke shall guide all strands of wire into terminal.
- G. Current bar shall ensure vibration-proof connection.
- H. Terminals:
  1. Capable of wire connections without special preparation other than stripping.
  2. Capable of jumper installation with no loss of terminal or rail space.
  3. Individual, rail mounted.
- I. Marking system allowing use of preprinted or field-marked tags.
- J. Manufacturers:
  1. Weidmuller.
  2. Ideal.
  3. Electrovert.

### **2.15 MAGNETIC CONTROL RELAY**

- A. NEMA ICS 2, Class A600 (600 volts, 10 amps continuous, 7,200VA make, 720VA break), industrial control with field convertible contacts.
- B. Time Delay Relay Attachment:
  1. Pneumatic type, timer adjustable from 0.2 to 60 seconds (minimum).

2. Field convertible from ON delay to OFF delay and vice versa.
- C. Latching Attachment: Mechanical latch having unlatching coil and coil clearing contacts.
- D. Manufacturers:
1. Cutler-Hammer; Type M-600.
  2. General Electric; Class 8501.

## **2.16 RESET TIMER**

- A. Drive: Synchronous motor, solenoid operated clutch.
- B. Mounting: Semi flush, panel.
- C. Contacts: 10-amp, 120-volt.
- D. Manufacturers:
1. Eagle Signal; Bulletin 125.
  2. Automatic Timing and Controls; Bulletin 305.

## **2.17 ELAPSED TIME METER**

- A. Drive: Synchronous motor.
- B. Range: 0 to 99,999.9 hours, non reset type.
- C. Mounting: Semi flush, panel.
- D. Manufacturers:
1. General Electric; Type 240, 2-1/2-inch Big Look.
  2. Eagle Signal; Bulletin 705.

## **2.18 MAGNETIC CONTACTOR**

- A. NEMA ICS 2, UL 508.
- B. Electrically operated, electrically held.
- C. Main Contacts:
1. Power driven in one direction with gravity dropout.
  2. Silver alloy with wiping action and arc quenchers.
  3. Continuous-duty, rated 30 amperes, 600-volt.
  4. Three-pole.
- D. Control: Two-wire.
- E. One normally open and one normally closed auxiliary contacts rated 10 amperes at 480-volt.
- F. Enclosure: NEMA 250, Type 12, unless otherwise shown.
- G. Manufacturers:

1. General Electric; CR 353.
2. Eaton (Cutler-Hammer).

## **2.19 MAGNETIC LIGHTING CONTACTOR**

- A. NEMA ICS 2, UL 508.
- B. Electrically operated by dual-acting, single coil mechanism.
- C. Inherently interlocked and electrically held in both OPEN and CLOSED position.
- D. Main Contacts:
  1. Power driven in both directions.
  2. Double-break, continuous-duty, rated 20 amperes, 600 volts, withstand rating of 22,000 amps rms symmetrical at 250 volts.
  3. Marked for electric discharge lamps, tungsten, and general-purpose loads.
  4. Position not dependent on gravity, hooks, latches, or semi-permanent magnets.
  5. Capable of operating in any position.
  6. Visual indication for each contact.
- E. Auxiliary contact relay for three-wire control.
- F. One normally open and one normally closed auxiliary contacts rated 10 amperes at 480-volt.
- G. Fully rated neutral plate.
- H. Provision for remote pilot lamp with use of auxiliary contacts.
- I. Clamp type, self-rising terminal plates for solderless connections.
- J. Enclosure: NEMA 250, Type 12, Dust-Tight, Drip-Tight, Industrial Use, unless otherwise shown.
- K. Manufacturers:
  1. ASCO.
  2. Westinghouse; Class A202.
  3. General Electric; Class 360.

## **2.20 INDUSTRIAL CAPACITORS**

- A. UL 810, NEMA CP1, ANSI C55.1, and NFPA 70, Article 460.
- B. Enclosed, outdoor, weatherproof, three-phase capacitor units containing internally mounted, indicating type, high interrupting-capacity, current limiting fuses and discharge resistors.
- C. Units containing PCB dielectric fluid are unacceptable.
- D. Kilovar Ratings:
  1. Kilovar ratings of capacitors connected to individual motor circuits were selected based on expected motor power factor.

2. Check motor nameplate and manufacturer's power factor and no-load current data for actual motor installed.
3. Reduce capacitor kVAR if required, so the size does not exceed the motor manufacturer's recommended maximum size, and so it does not exceed the value required to raise motor no-load power factor to 0.95.
4. Manufacturers:
  - a. ABB.
  - b. Square D.

## **2.21 THERMOSTAT**

- A. Rating: 7.4 amps continuous, 44 amps locked rotor current at 120 volts and 3.7 amps continuous, 22 amps locked rotor current at 240 volts.
- B. Line voltage, single-stage, treated to resist corrosion, dust, dirt, and humidity with sealed SPDT contacts.
- C. Heating Adjustment Range: 35 to 100 degrees F.
- D. Cooling or Ventilating Adjustment Range: 70 to 140 degrees F.
- E. Manufacturer: Honeywell; Type T631F1084.

## **2.22 DRY TYPE TRANSFORMER (0- TO 600-VOLT PRIMARY)**

- A. UL 1561, NEMA ST 20, unless otherwise indicated.
- B. Self-cooled, two-winding, UL K-4 rated for nonlinear loads.
- C. Insulation Class and Temperature Rise: Manufacturer's standard.
- D. Core and Coil:
  1. Encapsulated for single-phase units 1/2 to 25 kVA and for three-phase units 3 to 15 kVA.
  2. Thermosetting varnish impregnated for single-phase units 37.5 kVA and above, and for three-phase units 30 kVA and above.
- E. Enclosure:
  1. Single-Phase, 3 to 25 kVA: NEMA 250, Type 3R, non-ventilated.
  2. Single-Phase, 37-1/2 kVA and Above: NEMA 250, Type 2, ventilated.
  3. Three-Phase, 3 to 15 kVA: NEMA 250, Type 3R, nonventilated.
  4. Three-Phase, 30 kVA and Above: NEMA 250, Type 2, ventilated.
  5. Outdoor Transformers: NEMA 250, Type 3R.
- F. Wall Bracket: For single-phase units, 15 to 37-1/2 kVA, and for three-phase units, 15 to 30 kVA.
- G. Voltage Taps:
  1. Single-Phase, 3 to 10 kVA: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
  2. Single-Phase, 15 kVA and Above: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.

3. Three-Phase, 3 to 15 kVA: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
  4. Three-Phase, 30 kVA and Above: Four 2-1/2 percent, full capacity; two above and two below normal voltage rating.
- H. Impedance: 4.5 percent minimum on units 75 kVA and larger.
- I. Maximum Sound Level: NEMA ST 20:
1. 40 decibels for 0 to 9 kVA.
  2. 45 decibels for 10 to 50 kVA.
  3. 50 decibels for 51 to 150 kVA.
  4. 55 decibels for 151 to 300 kVA.
  5. 60 decibels for 301 to 500 kVA.
- J. Vibration Isolators:
1. Rated for transformer's weight.
  2. Isolation Efficiency: 99 percent, at fundamental frequency of sound emitted by transformer.
  3. Less Than 30 kVA: Isolate entire unit from structure with external vibration isolators.
  4. 30 kVA and Above: Isolate core and coil assembly from transformer enclosure with integral vibration isolator.
- K. Manufacturers:
1. Square D.
  2. Or approved equal.

## **2.23 LOW VOLTAGE, SECONDARY SURGE PROTECTIVE EQUIPMENT**

- A. NEMA LA1, ANSI C62. 11.
- B. Surge Capacitor:
1. Impregnated with non-PCB, biodegradable dielectric fluid.
  2. Integral discharge resistor which will drain residual voltage to 50 volts crest in less than 1 minute after disconnection from circuit.
- C. Arrestor: High strength metal oxide valve elements enclosed in high strength, corrosion resistant, molded resin housing.
- D. Equip capacitor and arrestor with mounting nipple, flat washer, and nut suitable for knockout or bracket mounting.

## **2.24 SUPPORT AND FRAMING CHANNELS**

- A. Material:
1. Dry indoors - galvanized.
  2. All Other Areas: ASTM A167, Type 316 stainless steel or fiber-reinforced epoxy, as required.
- B. Finish:
1. Dry indoors - galvanized.
  2. All Other Areas: ASTM A167, Type 316 stainless steel or fiber-reinforced epoxy, as required.

- C. Inserts: Continuous.
- D. Beam Clamps: Gray cast iron.
- E. Manufacturers:
  - 1. B-Line.
  - 2. Unistrut.

## **2.25 NAMEPLATES**

- A. Material: Laminated plastic.
- B. Attachment Screws: Stainless steel.
- C. Color: White, engraved to a black core.
- D. Engraving:
  - 1. Pushbuttons/Selector Switches: Name of drive controlled on one, two, or three lines, as required.
  - 2. Panelboards: Panelboard designation, service voltage, and phases.
- E. Letter Height:
  - 1. Pushbuttons/Selector Switches: 1/8 inch.
  - 2. Panelboards: 1/4 inch.

## **2.26 TRANSIENT VOLTAGE SURGE SUPPRESSION**

- A. This section describes the material and installation requirements for transient voltage surge suppression devices (TVSS) in switchboards, panelboards, and motor control centers for the protection of all AC electrical circuits.
- B. TVSS shall be listed and component recognized in accordance with UL 1449 and UL 1283.
- C. TVSS shall be installed and warranted by and shipped from the electrical distribution equipment manufacturer's factory.
- D. TVSS shall provide surge current diversion paths for all modes of protection; L-L, L-N, L-G, N-G in WYE systems, and L-L, L-G in DELTA systems.
- E. TVSS shall be modular in design. Each module shall be fused with a surge rated fuse.
- F. A UL approved disconnect switch shall be provided as a means of disconnect in the switchboard device only.
- G. TVSS shall meet or exceed the following criteria:
  - 1. Maximum surge current capability (single pulse rated) shall be:
    - a. Service entrance switchboard 300kA
    - b. Branch panelboards 150kA
    - c. Motor control centers 80kA
  - 2. UL 1449 Listed and Recognized Component Suppression Voltage Ratings shall not exceed the following:



<u>Voltage</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120	400V	400V	400V
480Y/277	800V	800V	800V

- H. TVSS shall have a minimum EMI/RFI filtering of -44dB at 100kHz with an insertion ration of 50:1 using MIL STD. 220A methodology.
- I. TVSS shall be provided with 1 set of NO/NC dry contacts.
- J. TVSS shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period. Warranty will be the responsibility of the electrical distribution equipment manufacturer.
- K. Approved manufactures are:
  1. General Electric Tranquell Series.
  2. Cutler Hammer CPS Series.
  3. Siemans TPS Series.
  4. Square D Company XTE Series.
  5. Current Technology.
  6. No approved or equal.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Install equipment in accordance with NECA 5055.

### **3.02 OUTLET AND DEVICE BOXES**

- A. Install suitable for conditions encountered at each outlet or device in the wiring or raceway system, sized to meet NFPA 70 requirements.
- B. Size:
  1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
    - a. Hollow Masonry Construction: Install with sufficient depth such that conduit knockouts or hubs are in masonry void space.
  2. Ceiling Outlet: Minimum 4-inch octagonal sheet steel device box, unless otherwise required for installed fixture.
  3. Switch and Receptacle: Minimum 2-inch by 4-inch sheet steel device box.
- C. Locations:
  1. Drawing locations are approximate.
  2. To avoid interference with mechanical equipment or structural features, relocate outlets as directed by engineer.
  3. Light Switch: Install on lock side of doors.
  4. Light Fixture: Install in symmetrical pattern according to room layout unless otherwise shown.
- D. Mounting Height:
  1. General:

- a. Measured to centerline of box.
    - b. Where specified heights do not suit building construction or finish, mount as directed by ENGINEER.
  - 2. Light Switch: 48 inches above floor.
  - 3. Thermostat: 54 inches above floor.
  - 4. Telephone Outlet: 6 inches above counter tops or 15 inches above floor.
  - 5. Wall Mounted Telephone Outlet: 52 inches above floor.
  - 6. Convenience Receptacle:
    - a. General Interior Areas: 15 inches above floor.
    - b. General Interior Areas (Counter Tops): Install device plate bottom or side flush with top of splashback, or 6 inches above countertops without splashback.
    - c. Industrial Areas, Workshops: 48 inches above floor.
    - d. Outdoor, All Areas: 24 inches above finished grade.
  - 7. Special-Purpose Receptacle: 54 inches above floor or as shown.
- E. Install plumb and level.
- F. Flush Mounted:
- 1. Install with concealed conduit.
  - 2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.
  - 3. Holes in surrounding surface shall be no larger than required to receive box.
- G. Support boxes independently of conduit by attachment to building structure or structural member.
- H. Install bar hangers in frame construction, or fasten boxes directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws threaded into steelwork.
- I. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
- J. Provide plaster rings where necessary.
- K. Boxes embedded in concrete or masonry need not be additionally supported.
- L. Install stainless steel mounting hardware in industrial areas.
- M. Boxes Supporting Fixtures: Provide means of attachment with adequate strength to support fixture.
- N. Open no more knockouts in sheet steel device boxes than are required; seal unused openings.
- O. Box Type (Steel Raceway System):
- 1. Exterior Locations:
    - a. Exposed Raceways: Cast metal.
    - b. Concealed Raceways: Cast metal.
    - c. Concrete Encased Raceways: Cast metal.
    - d. Class I, II, or III Hazardous Areas: Cast metal.
  - 2. Interior Dry Locations:

- a. Exposed Rigid Conduit: Cast metal.
  - b. Exposed EMT: Sheet steel.
  - c. Concealed Raceways: Sheet steel.
  - d. Concrete Encased Raceways: Cast metal.
  - e. Lighting Circuits, Ceiling: Sheet steel.
  - f. Class I, II, or III Hazardous Areas: Cast metal.
3. Interior Wet Locations:
- a. Exposed Raceways: Cast metal.
  - b. Concealed Raceways: Cast metal.
  - c. Concrete Encased Raceways: Cast metal.
  - d. Lighting Circuits, Ceiling: Sheet steel.
  - e. Class I, II, or III Hazardous Areas: Cast metal.
4. Cast-In-Place Concrete Slabs: Sheet steel.
- P. Box Type (Rigid Aluminum Raceway System): Cast aluminum.
- Q. Box Type (Nonmetallic Raceway System):
- 1. Corrosive Locations: Nonmetallic.
  - 2. Exposed Raceways: Nonmetallic.
  - 3. Concealed Raceways: Nonmetallic.
  - 4. Concrete Encased Raceways: Nonmetallic.
- R. Box Type, Corrosive Locations (PVC-Coated Rigid Galvanized Steel Raceway System): PVC coated cast metal..

### **3.03 JUNCTION AND PULL BOXES**

- A. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.
- B. Install pull boxes where necessary in raceway system to facilitate conductor installation.
- C. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.
- D. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.
- E. Installed boxes shall be accessible.
- F. Do not install on finished surfaces.
- G. Install plumb and level.
- H. Support boxes independently of conduit by attachment to building structure or structural member.
- I. Install bar hangers in frame construction, or fasten boxes directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded threaded studs on steelwork.

- J. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
- K. Boxes embedded in concrete or masonry need not be additionally supported.
- L. At or Below Grade:
  1. Install boxes for below grade conduits flush with finished grade in locations outside of paved areas, roadways, or walkways.
  2. If adjacent structure is available, box may be mounted on structure surface just above finished grade in accessible but unobtrusive location.
  3. Obtain ENGINEER's written acceptance prior to installation in paved areas, roadways, or walkways.
  4. Use boxes and covers suitable to support anticipated weights.
- M. Flush Mounted:
  1. Install with concealed conduit.
  2. Holes in surrounding surface shall be no larger than required to receive box.
  3. Make edges of boxes flush with final surface.
- N. Mounting Hardware:
  1. Noncorrosive Interior Areas: Galvanized.
  2. All Other Areas: Stainless steel.
- O. Location/Type:
  1. Finished, Indoor, Dry: NEMA 250, Type 1.
  2. Unfinished, Indoor, Dry: NEMA 250, Type 12.
  3. Unfinished, Indoor and Outdoor, Wet and Corrosive: NEMA 250, Type 4X.
  4. Unfinished, Indoor and Outdoor, Wet, Dust, or Oil: NEMA 250, Type 13.
  5. Unfinished, Indoor and Outdoor, Hazardous: NEMA 250, Type 7 and Type 9, where indicated.
  6. Underground Conduit: Concrete Encased.
  7. Corrosive Locations: Nonmetallic.

### **3.04 TELEPHONE TERMINAL CABINET (TTC)**

- A. N/A

### **3.05 TELEPHONE OUTLET**

- A. N/A.

### **3.06 ENCLOSURES AND JUNCTION BOXES**

- A. ENCLOSRES AND JUNCTION BOXES IN CLIMATE CONTROL
  1. Enclosures or junction boxes located inside and continuously climate controlled environments can be constructed of painted carbon steel.
  2. NEMA rating shall be 12.
  3. Enclosures to come with continuous hinge and 3 point latch.
- B. ENCLOSRES AND JUNCTION BOXES NOT IN CLIMATE CONTROL
  1. Any enclosure or junction box located outside, whether sheltered or not shall be constructed of aluminum or 316 stainless steel powder coated white.
  2. NEMA rating shall be 4X.

3. Enclosures to come with a continuous hinge, 3 point latch and screw down clamps.
4. Junction boxes to come with continuous hinge and quick connect door clamp. Do NOT provide flush mounted screw down fronts.
5. All enclosure hardware should be 316 stainless steel.
6. All enclosures and junction boxes shall be tagged with a two color (black/white) hard plastic engraved tag reference.

### **3.07 WIRING DEVICES**

- A. Switches:
  1. Mounting Height: See Paragraph Outlet and Device Boxes.
  2. Install with switch operation in vertical position.
  3. Install single-pole, two-way switches such that toggle is in up position when switch is on.
- B. Receptacles:
  1. Install with grounding slot down except where horizontal mounting is shown, in which case install with neutral slot up.
  2. Ground receptacles to boxes with grounding wire only.
  3. Weatherproof Receptacles:
    - a. Install in cast metal box.
    - b. Install such that hinge for protective cover is above receptacle opening.
  4. Ground Fault Interrupter: Install feed-through model at locations where ground fault protection is specified for "downstream" conventional receptacles.
  5. Special-Purpose Receptacles: Install in accordance with manufacturer's instructions.
  6. Cover plates for devices requiring them shall be 304 stainless steel except on cast boxes, provide cast covers for cast boxes.
  7. All outside receptacles (weatherproof) shall be duplex GVCI cast cover plates.
- C. Multioutlet Surface Raceway System:
  1. Install in accordance with manufacturer's instructions.
  2. Wire alternate outlets to each circuit where two-circuit, three-wire supply is shown.

### **3.08 DEVICE PLATES**

- A. Securely fasten to wiring device; ensure a tight fit to the box.
- B. Flush Mounted: Install with all four edges in continuous contact with finished wall surfaces without use of mats or similar materials. Plaster fillings will not be acceptable.
- C. Surface Mounted: Plate shall not extend beyond sides of box unless plates have no sharp corners or edges.
- D. Install with alignment tolerance to box of 1/16 inch.
- E. Engrave with designated titles.
- F. Types (Unless Otherwise Shown):
  1. Office: Stainless Steel.

2. Exterior: Weatherproof.
3. Interior:
  - a. Flush Mounted Boxes: Stainless Steel.
  - b. Surface Mounted, Cast Metal Boxes: Cast metal.
  - c. Surface Mounted, Sheet Steel Boxes: Stainless Steel.
  - d. Surface Mounted, Nonmetallic Boxes: Plastic.

### **3.09 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH**

- A. Heavy-Duty, Oiltight Type: Locations (Unless Otherwise Shown): Non hazardous, indoor, dry locations, including motor control centers, control panels, and individual stations.
- B. Heavy-Duty, Watertight, and Corrosion-Resistant Type:
  1. Locations (Unless Otherwise Shown): Non hazardous, outdoor, or normally wet areas.
  2. Mounting: NEMA 250, Type 4X enclosure.

### **3.10 TERMINAL JUNCTION BOX**

- A. Install in accordance with Paragraph JUNCTION AND PULL BOXES.
- B. Label each block and terminal with permanently attached, non destructible tag.
- C. Do not install on finished outdoor surfaces.
- D. Location:
  1. Finished, Indoor, Dry: NEMA 250, Type 1.
  2. Unfinished, Indoor, Dry: NEMA 250, Type 12.
  3. Unfinished, Indoor and Outdoor, Wet and Corrosive: NEMA 250, Type 4X.
  4. Unfinished, Indoor and Outdoor, Wet, Dust, or Oil: NEMA 250, Type 13.

### **3.11 LIGHTING AND POWER DISTRIBUTION PANELBOARD**

- A. Install securely, plumb, in-line and square with walls.
- B. Install top of cabinet 6 feet above floor unless otherwise shown.
- C. Provide typewritten circuit directory for each panelboard.

### **3.12 INDUSTRIAL CAPACITORS**

- A. Provide suitable hangers or mounting brackets for wall or ceiling mounting.

### **3.13 DRY TYPE TRANSFORMER (0- TO 600-VOLT PRIMARY)**

- A. Load external vibration isolator such that no transformer unit metal is in direct contact with mounting surface.
- B. Provide moistureproof, flexible conduit for electrical connections.
- C. Connect voltage taps to achieve (approximately) rated output voltage under normal plant load conditions.

- D. Provide wall brackets for single-phase units, 15 to 167-1/2 kVA, and three-phase units, 15 to 112 kVA.

#### **3.14 SUPPORT AND FRAMING CHANNEL**

- A. Furnish zinc-rich primer; paint cut ends prior to installation, where applicable.
- B. Install where required for mounting and supporting electrical equipment and raceway systems.

#### **3.15 MOTOR SURGE PROTECTION**

- A. Ground in accordance with NFPA 70.
- B. Low Voltage: Ground terminals to equipment bus.

END OF SECTION





## SECTION 26\_05\_05

### CONDUCTORS

#### PART 1 GENERAL

##### 1.01 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
1. American National Standards Institute (ANSI): 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
  2. American Society for Testing and Materials (ASTM):
    - a. A167, Standard Specification for Stainless and Heat Resisting Chromium-Nickel-Plated Steel Plate, Sheet, and Strip.
    - b. B3, Standard Specification for Soft or Annealed Copper Wire.
    - c. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
    - d. B263, Standard Test Method for Determination of Cross-Sectional Area of Stranded Conductors.
  3. Association of Edison Illuminating Companies (AEIC):
    - a. CS 5, Crosslinked Polyethylene Insulated Shielded Power Cables Rated 5 Through 35 kV.
    - b. CS 6, Ethylene-Propylene-Rubber-Insulated Shielded Power Cables Rated 5 Through 69 kV.
  4. Insulated Cable Engineer's Association, Inc. (ICEA): T-29-250, Procedure for Conducting Vertical Cable Tray Flame Test With a Theoretical Heat Input of 210,000 Btu/hour.
  5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. 48, Standard Test Procedures and Requirements for High-Voltage Alternating Current Cable Terminations.
    - b. 404, Standard for Cable Joints for Use with Extruded Dielectric Cable Rated 5,000V through 46,000V and Cable Joints for Use with Laminated Dielectric Cable Rated 2,500V through 500,000V.
  6. National Electrical Contractors Association, Inc. (NECA): 5055, Standard of Installation.
  7. National Electrical Manufacturers' Association (NEMA):
    - a. CC 1, Electric Power Connectors for Substations.
    - b. WC 3, Rubber-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - c. WC 5, Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - d. WC 7, Crosslinked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - e. WC 8, Ethylene-Propylene-Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
    - f. WC 55, Instrumentation Cables and Thermocouple Wire.
  8. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
  9. Underwriters Laboratories, Inc. (UL):
    - a. 13, Standard for Safety Power-Limited Circuit Cables.

- b. 44, Standard for Safety Rubber-Insulated Wires and Cables.
- c. 62, Standard for Safety Flexible Cord and Fixture Wire.
- d. 486A, Standard for Safety Wire Connector and Soldering Lugs for Use with Copper Conductors.
- e. 486B, Standard for Safety Wire Connectors and Soldering Lugs for Use with Aluminum Conductors.
- f. 510, Standard for Safety Insulating Tape.
- g. 854, Standard for Safety Service-Entrance Cables.
- h. 910, Standard for Safety Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air Handling Spaces.
- i. 1072, Standard for Safety Medium-Voltage Power Cables.
- j. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
- k. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.

## 1.02 SUBMITTALS

- A. Shop Drawings:
  - 1. Wire and cable descriptive product information.
  - 2. Wire and cable accessories descriptive product information.
- B. Quality Control Submittals:
  - 1. Certified Factory Test Report for conductors 600 volts and below.
  - 2. Certified Factory Test Report per AEIC CS6, including AEIC qualification report for conductors above 600 volts.

## 1.03 UL COMPLIANCE

- A. Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.

## PART 2 PRODUCTS

### 2.01 CONDUCTORS 600 VOLTS AND BELOW

- A. Conform to applicable requirements of NEMA WC 3, WC 5, and WC 7.
- B. Conductor Type:
  - 1. 120- and 277-Volt Lighting, No. 10 AWG and Smaller: Stranded copper.
  - 2. 120-Volt Receptacle Circuits, No. 10 AWG and Smaller: Stranded copper.
  - 3. All Other Circuits: Stranded copper.
- C. All power conductors shall be copper with XHHW-2 Insulation.
- D. Direct Burial and Aerial Conductors and Cables:
  - 1. Type USE/RHH/RHW insulation, UL t (54 listed, Type RHW-2/USE-2.
  - 2. Conform to physical and minimum thickness requirements of NEMA WC 3.
- E. Flexible Cords and Cables:
  - 1. Type SOW-A50 with ethylene propylene rubber insulation in accordance with UL 62.

2. Conform to physical and minimum thickness requirements of NEMA WC 8.

F. Cable Tray Conductors and Cables: Type TC.

**2.02 600-VOLT RATED CABLE**

A. General:

1. Type: TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 20,000 Btu/hr, and NFPA 70, Article 340, or UL 13 Listed Power Limited Circuit Cable meeting requirements of NFPA 70, Article 725.
2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
3. Suitable for installation in open air, in cable trays, or conduit.
4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

B. Wire and Connectors:

1. Cable shall be rated for 600 volts and shall meet the requirements below:
2. Conductors shall be stranded.
3. All wire shall be brought to the job in unbroken packages and shall bear the data of manufacturing; not older than 12 months.
4. Type of wire shall be XHHW or THHN, rated 75 degrees C suitable for wet locations except where required otherwise by the drawings.
5. No wire smaller than No. 12 gauge shall be used unless specifically indicated.
6. Conductor metal shall be copper.
7. All conductors shall be megger tested after installation and insulation must be in compliance with the Insulated Power Cable Engineers Association Minimum Values of Insulation Resistance.

C. Type I-Multiconductor Control Cable:

1. Conductors:
  - a. No. 14 AWG, seven-strand copper.
  - b. Insulation: 15-mil PVC with 4-mil nylon.
  - c. UL 1581 listed as Type THHN/THWN rated VW-I.
  - d. Conductor group bound with spiral wrap of barrier tape.
  - e. Color Code: In accordance with NEMA WC 5, Method 1, Sequence K-2.
2. Cable: Passes the ICEA T-29-520 210,000 Btu/hr Vertical Tray Flame Test.
3. Cable Sizes:

No. of Conductors	Max. Outside Diameter (inches)	Jacket Thickness (mils)
3	0.41	45
5	0.48	45
7	0.52	45
12	0.72	60
19	0.83	60
25	1.00	60
37	1.15	80

4. Manufacturers:
    - a. Okonite Co.
    - b. Rome Cable.
- D. Type 2-Multiconductor Power Cable:
1. Conductors:
    - a. Class B stranded, coated copper.
    - b. Insulation: Chemically crosslinked ethylene-propylene with Hypalon jacket.
    - c. UL 1581 listed as Type EPR, rated VW-1.
    - d. Color Code: Conductors, size No. 8 AWG and smaller, colored conductors, NEMA WC5 Method 1, color 5 per Article Power Conductor Color Coding. Conductors, size No. 6 AWG and larger, NEMA WC5, Method 4.
  2. Cable pass the ICEA T-29-520 210,000 Btu/hr Vertical Tray Flame Test.
  3. Cable Sizes:

Conductor Size	Minimum Ground Wire Size	No. of Conductors	Max. Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
12	12	2	0.42	45
		3	0.45	45
		4	0.49	45
10	10	2	0.54	60
		3	0.58	60
		4	0.63	60
8	10	3	0.66	60
		4	0.72	60
6	8	3	0.74	60
		4	0.81	60
4	6	3	0.88	60
		4	0.97	80
2	6	3	1.01	80
		4	1.11	80
1/0	6	3	1.22	80
		4	1.35	80
2/0	4	3	1.32	80
		4	1.46	80
4/0	4	3	1.56	80
		4	1.78	80

4. Manufacturers:
    - a. Okonite Co.
    - b. Pome Cable.
- E. Type B-No. 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.
1. Outer Jacket: 45-mil nominal thickness.
  2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
  3. Dimension: 0.31-inch nominal OD.

4. Conductors:
    - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    - b. 20 AWG, seven-strand tinned copper drain wire.
    - c. Insulation: 15-mil nominal PVC.
    - d. Jacket: 4-mil nominal nylon.
    - e. Color Code: Pair conductors black and red.
  5. Manufacturers:
    - a. Okonite Co.
    - b. Alpha Wire Corp
    - c. Belden.
  6. The following test shall be performed on instrumentation and control system cables. All tests shall be end-to-end test of installed cables with the ends supported in free air, not adjacent to any ground object. All test data shall be recorded on forms acceptable to the Engineer. Complete records of all tests shall be made and delivered to the Engineer.
    - a. Continuity tests shall be performed by measuring wire/shield loop resistances of signal cable as the wires, taken one at a time, are shorted to the channel shield. No loop resistance measurement shall carry by more than  $\pm 2$  ohms from the calculated average loop resistance value.
    - b. Insulation resistance tests shall be performed by using a 500 volt megohmmeter to measure the insulation resistance between each channel wire and channel shield, between individual channel shields in a multi-channel cable, between each individual channel and the overall cable shield in multi-channel cable, between each wire and ground, and between each shield and ground. Values of resistance less than 10 megohms shall be unacceptable.
- F. Type B1-No. 16 AWG, Twisted, Shielded Triad Instrumentation Cable: Single triad, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.
1. Outer Jacket: 45-mil nominal.
  2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
  3. Dimension: 0.32-inch nominal OD.
  4. Conductors:
    - a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    - b. 20 AWG, seven-strand, tinned copper drain wire.
    - c. Insulation: 15-mil nominal PVC.
    - d. Jacket: 4-mil nylon.
    - e. Color Code: Triad conductors black, red, and white.
  5. Manufacturers:
    - a. Okonite Co.
    - b. Alpha Wire Corp.
    - c. Belden.
- G. Type B2-No. 18 AWG, Multi-Twisted, Shielded Pairs with a Common, Overall Shield Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable, meeting NEMA WC 55 requirements.
1. Conductors:

- a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8
  - b. Tinned copper drain wires.
  - c. Pair drain wire size AWG 20, group drain wire size AWG 18.
  - d. Insulation: 15-mil PVC.
  - e. Jacket: 4-mil nylon.
  - f. Color Code: Pair conductors black and red with red conductor numerically printed for group identification.
  - g. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer.
2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.
  3. Cable Sizes:

<b>Number of Pairs</b>	<b>Maximum Outside Diameter (inches)</b>	<b>Nominal Jacket Thickness (mils)</b>
4	0.50	45
8	0.68	60
12	0.82	60
16	0.95	80
24	1.16	80
36	1.33	80
50	1.56	80

4. Manufacturers:
  - a. Okonite Co.
  - b. Alpha Wire Corp.

H. Type B3-No. 18 AWG, Multi-twisted Pairs with a Common Overall Shield  
Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable meeting NEMA WC 55.

1. Conductors:
  - a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
  - b. Tinned copper drain wire size 18 AWG.
  - c. Insulation: 15-mil nominal PVC.
  - d. Jacket: 4-mil nylon.
  - e. Color Code: Pair conductors black and red, with red conductor numerically printed for group identification.
2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.
3. Cable Sizes:

<b>Number Of Pairs</b>	<b>Maximum Outside Diameter (inches)</b>	<b>Nominal Jacket Thickness (mils)</b>
4	0.46	45
8	0.63	60
12	0.75	60

<b>Number Of Pairs</b>	<b>Maximum Outside Diameter (inches)</b>	<b>Nominal Jacket Thickness (mils)</b>
16	0.83	60
24	1.06	80
36	1.21	80
50	1.42	80

4. Manufacturers:
  - a. Okonite Co.
  - b. Alpha Wire Corp.
  
- I. Variable Frequency Drive (VFD) Output Power Cable:
  1. Section applies to power cables routed between the output of VFD's and motor terminals.
  2. Cable shall be rated for 600 volts type MC and shall meet the requirements below:
    - a. Conductors shall be stranded copper.
    - b. All wire shall be brought to the job in unbroken packages and shall bear the data of manufacturing; not older than 12 months.
    - c. Type of wire shall be XHHW or RHW rated 75 degrees C suitable for wet locations.
    - d. No wire smaller than No. 12 gauge shall be used unless specifically indicated.
    - e. Cable construction shall consist of three insulated current-carrying phase conductors and three bare ground conductors, symmetrically placed between the phase conductors, and twisted beneath a continuous aluminum armor and overall polymeric jacket.
    - f. Armor must be continuous corrugated aluminum armor (CCA) manufacture. Aluminum interlocked armor (AIA) construction is not acceptable.
  3. Each ground conductor size (circular mil area) shall be one-third (1/3) of the NEC required size (circular mil area) for a single ground conductor. If one third of the required circular mil area does not correspond to a standard size (circular mil area) of construction, the next largest size of standard construction shall be used. All conductors shall be megger tested after installation and insulation must be in compliance with the Insulated Power Cable Engineers Association Minimum Values of Insulation Resistance.
  4. Manufacturers:
    - a. Southwire – ARMOR-X.
    - b. Approved Equal.
  
- J. Ethernet Cat. 6e UTP Cable (Copper):
  1. Section applies to all Ethernet Cable (Copper) except for Fiber Optic cable.
  2. Conductor Physical Characteristics: 4 twisted pairs (8 conductors), 23 AWG solid bare Copper with Polyolefin Insulation. Overall Nominal Diameter: 0.235 inch. Operating Temperature Range: -20°C to +75°C. Model Number – 7881A, Belden Inc.
  3. NEC/UL specification CMR, UL444, UL verified category 6.
  4. Manufacturer: Belden Inc.

## 2.03 GROUNDING CONDUCTORS

- A. Equipment: Stranded copper with green, Type USE/RHH/RHW-XLPE or THHN/THWN, insulation.
- B. Direct Buried: Bare stranded copper.

## 2.04 ACCESSORIES FOR CONDUCTORS 600 VOLTS AND BELOW

- A. Tape:
  - 1. General Purpose, Flame Retardant: 7-mil, vinyl plastic, Scotch Brand 33, rated for 90 degrees C minimum, meeting requirements of UL 510.
  - 2. Flame Retardant, Cold and Weather Resistant: 8.5-mil, vinyl plastic, Scotch Brand 88.
  - 3. Arcs and Fireproofing:
    - a. 30-mil, elastomer
    - b. Manufacturers and Products:
      - 1) Scotch; Brand 77, with Scotch Brand 69 glass cloth tape binder.
      - 2) Plynount; Plyarc 30, with Plymount Plyglas glass cloth tape binder.
- B. Identification Devices:
  - 1. Sleeve: Permanent, PVC, yellow or white, with legible machine-printed black markings.
  - 2. Marker Plate: Nylon, with legible designations permanently hot stamped on plate.
  - 3. Grounding Conductor: Permanent green heat-shrink sleeve, 2-inch minimum.
- C. Connectors and Terminations:
  - 1. Nylon, Self-Insulated Crimp Connectors:
    - a. Manufacturers and Products:
      - 1) Thomas & Betts; Sta-Kon.
      - 2) Burndy; Insulink.
      - 3) ILSCO.
  - 2. Nylon, Self-Insulated, Crimp Locking-Fork, Torque-Type Terminator:
    - a. Manufacturers and Products:
      - 1) Thomas & Betts; Sta-Kon.
      - 2) Burndy; Insulink.
      - 3) ILSCO.
- D. Cable Lugs:
  - 1. In accordance with NEMA CC I.
  - 2. Rated 600 volts of same material as conductor metal.
  - 3. Insulated, Locking-Fork, Compression Lugs:
    - a. Manufacturers and Products:
      - 1) Thomas & Betts; Sta-Kon.
      - 2) ILSCO; ILSCONS.
  - 4. Un-insulated Crimp Connectors and Terminators:
    - a. Manufacturers and Products:
      - 1) Square D; Versitide.
      - 2) Thomas & Betts; Color-Keyed.
      - 3) ILSCO.
  - 5. Un-insulated, Bolted, Two-Way Connectors and Terminators:
    - a. Manufacturers and Products:



- 1) Thomas & Betts; Locktite.
- 2) Burndy; Quiklug.
- 3) ILSCO.

- E. Cable Ties: Nylon, adjustable, self-locking, and reusable.
1. Manufacturers and Product: Thomas & Betts; TY-RAP.
- F. Heat Shrinkable Insulation: Thermally stabilized, crosslinked polyofin.
1. Manufacturers and Product: Thomas & Betts; SHRINK-KON.

## **2.05 PULLING COMPOUND**

- A. Nontoxic, non-corrosive, noncombustible, nonflammable, wax-based lubricant; UL listed.
- B. Suitable for rubber, neoprene, PVC, polyethylene, hypalon, CPE, and lead-covered wire and cable.
- C. Suitable for zinc-coated steel, aluminum, PVC, bituminized fiber, and fiberglass raceways.
- D. Manufacturers and Products:
1. Ideal Co.; Yellow 77.
  2. Polywater, Inc.
  3. Cable Grip Co.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Conductor installation to be in accordance with NECA 5055.
- B. Conductor and cable sizing shown is based on copper conductors, unless noted otherwise.
- C. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.
- D. Tighten screws and terminal bolts in accordance with UL 486A for copper conductors.
- E. Cable Lugs: Provide with correct number of holes, bolt size, and center-to-center spacing as required by equipment terminals.
- F. Bundling: Where single conductors and cables in manholes, hand holes, vaults, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 18 inches on center.
- G. Ream, remove burrs, and clear interior of installed conduit before pulling wires or cables.

- H. Concrete-Encased Raceway Installation: Prior to installation of conductors, pull through each raceway a mandrel approximately 1/4-inch smaller than raceway inside diameter.
- I. Cable Tray Installation:
  - 1. Install wire and cable parallel and straight in tray.
  - 2. Bundle, in groups, all wire and cable of same voltage having a common routing and destination; use cable ties, at maximum intervals of 8 feet.
  - 3. Clamp cable bundles prior to making end termination connections.
  - 4. Separate cables of different voltage rating in same cable tray with barriers.
  - 5. Fasten wires, cables, and bundles to tray with nylon cable straps at the following maximum intervals:
    - a. Horizontal Runs: 20 feet.
    - b. Vertical Runs: 5 feet.

### 3.02 POWER CONDUCTOR COLOR CODING

- A. Conductors 600 Volts and Below:
  - 1. No. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 to 2 inches wide.
  - 2. No. 8 AWG and Smaller: Provide colored conductors.
  - 3. Colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120 Volts Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts Three-Phase, Four-Wire Delta, Center Tap Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	Gray Brown Orange Yellow
NOTE: Phase A, B, C implies direction of positive phase rotation		

- 4. Tracer: Outer covering of white with an identifiable colored strip other than green in accordance with NFPA 70.

- B. Conductors Above 600 Volts: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 to 2 inches wide.
  - 1. Colors:

- a. Grounded Neutral: White.
- b. Phase A: Brown.
- c. Phase B: Orange.
- d. Phase C: Yellow.

### **3.03 CIRCUIT IDENTIFICATION**

- A. Circuits Appearing in Circuit Schedules: identify power, instrumentation, and control conductor circuits, using circuit schedule designations, at each termination and in accessible locations such as manholes, hand holes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.
- B. Circuits Not Appearing in Circuit Schedules:
  1. Assign circuit name based on device or equipment at load end of circuit.
  2. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
  - 3.
- C. Method:
  1. Conductors No. 3 AWG and Smaller: Identify with sleeves.
  2. Cables, and Conductors No. 2 AWG and Larger:
    - a. Identify with marker plates.
    - b. Attach marker plates with nylon tie cord.
  3. Taped-on markers or tags relying on adhesives not permitted.

### **3.04 CONDUCTORS 600 VOLTS AND BELOW**

- A. Install 10 AWG or 12 AWG conductors for branch circuit power wiring in lighting and receptacle circuits.
- B. Do not splice incoming service conductors and branch power distribution conductors No. 6 AWG and larger unless specifically indicated or approved by Engineer.
- C. Connections and Terminations:
  1. Install wire nuts only on solid conductors.
  2. Install nylon self-insulated crimp connectors and terminators for instrumentation, control, and power circuit conductors No. 6 AWG and smaller.
  3. Install un-insulated crimp connectors and terminators for instrumentation, control, and power circuit conductors No. 4 AWG through No. 2/0 AWG.
  4. Install un-insulated, bolted, two-way connectors and terminators for power circuit conductors No. 4/0 AWG and larger.
  5. Install un-insulated bolted, two-way connectors for motor circuit conductors No. 12 and larger.
  6. Tape insulates all un-insulated connections.
  7. Place no more than one conductor in any single-barrel pressure connection.
  8. Install crimp connectors with tools approved by connector manufacturer.
  9. Install terminals and connectors acceptable for type of material used.
  10. Compression Lugs
    - a. Attach with a tool specifically designed for purpose.
    - b. Tool shall provide complete controlled crimp and shall not release until crimp is complete.

- c. Do not use plier type crimpers.
- D. Do not use soldered mechanical joints.
- E. Splices and Terminations:
  - 1. Indoors: Use general purpose, flame retardant tape.
  - 2. Outdoors: Use flame retardant, cold- and weather-resistant tape.
- F. Cap spare conductors and conductors with UL listed end caps.
- G. Cabinets, Panels, and Motor Control Centers:
  - 1. Remove surplus wire, bridle and secure.
  - 2. Where conductors pass through openings or over edges in sheet metal, remove bums, chamfer edges, and install bushings and protective strips of insulating material to protect the conductors.
- H. Control and Instrumentation Wiring:
  - 1. Where terminals provided will accept such lugs, terminate control and instrumentation wiring, except solid thermocouple leads, with insulated, locking-fork compression lugs.
  - 2. Terminate with methods consistent with terminals provided, and in accordance with terminal manufacturer's instructions.
  - 3. Locate splices in readily accessible cabinets or junction boxes using terminal strips.
  - 4. Cable Protection:
    - a. Under Infinite Access Floors: May be installed without bundling.
    - b. All Other Areas: Install individual wires, pairs, or triads in flex conduit under the floor or grouped into bundles at least 1/2-inch in diameter.
    - c. Maintain integrity of shielding of instrumentation cables.
    - d. Ensure grounds do not occur because of damage to jacket over the shield.
- I. Extra Conductor Length: For conductors to be connected by others, install minimum 6 feet of extra conductor in freestanding panels and minimum 2 feet in other assemblies.
- J. Variable Frequency Drive (VFD) Output Power Cable:
  - 1. Install cables in raceway.
  - 2. Terminate the three ground conductors together at the motor and at the ground bus of the VFD.
  - 3. Terminate aluminum armor at motor and at VFD. At motor, terminate shield with cable manufacturer recommended termination kit. Termination shall be to the motor junction box. At the VFD, terminate armor to the inverter drive frame. The termination kit must provide a 360-degree connection of the armor to frame and motor junction box.
  - 4. Cable armor and ground conductors shall be made continuous through disconnects or splice boxes where un-grounded conductors are terminated on a terminal block or cable lug. Use manufacturer recommended shield termination kits and connect pigtails together. The cable shield shall not be connected to the disconnect switch or box enclosure.

### **3.05 CONDUCTOR ARC AND FIREPROOFING**

- A. Install arc and fireproofing, tape on 600-volt single conductors and cables except those rated Type TC in manholes, hand holes, vaults, cable trays, and other indicated locations.
- B. Install arc and fireproofing tape on 15 kV cables throughout their entire exposed length in manholes, hand holes, vaults, cable trays, and other indicated locations.
- C. Wrap conductors of same circuit entering from separate conduit together as a single cable.
- D. Follow tape manufacturer's installation instructions.
- E. Secure tape at intervals of 5 feet with bands of tape binder. Each tape band shall consist of a minimum of two wraps directly over each other.

### **3.06 UNDERGROUND DIRECT BURIAL CABLE**

- A. Install in trench as required.
- B. Warning Tape: Install approximately 12 inches above cable, aligned parallel to, and within 12 inches of centerline of the run.

### **3.07 FIELD QUALITY CONTROL**

- A. In accordance with the Contract Documents.

END OF SECTION



## SECTION 26\_05\_26

### GROUNDING

#### PART 1 GENERAL

##### 1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
  - 1. American National Standards Institute (ANSI): C2, National Electrical Safety Code (NESC).
  - 2. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC)

##### 1.02 SUBMITTALS

- A. Shop Drawings:
  - 1. Product Data:
    - a. Exothermic weld connectors.
    - b. Mechanical connectors.

##### 1.03 UL COMPLIANCE

- A. Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.

#### PART 2 PRODUCTS

##### 2.01 GROUND ROD

- A. Material: Copper clad.
- B. Diameter: 5/8 inch.
- C. Length: 20 feet.

##### 2.02 GROUND CONDUCTORS

- A. As specified in Section 26\_05\_05, Conductors.

##### 2.03 CONNECTORS

- A. Exothermic Weld Type:
  - 1. Outdoor Weld: Suitable for exposure to elements or direct burial.
  - 2. Indoor Weld: Utilize low-smoke, low-emission process.
  - 3. Manufacturers:
    - a. Erico Products, Inc.; Cadweld and Cadweld Exolon.
    - b. Thermoweld.

- B. Mechanical Type: Split-bolt, saddle, or cone screw type; copper alloy material.
  - 1. Manufacturers:
    - a. Burndy Corp.
    - b. Thomas and Betts Co.

## **2.04 GROUNDING WELLS**

- A. Ground rod box complete with cast iron riser ring and traffic cover marked GROUND ROD.
- B. Manufacturers:
  - 1. Christy Co.; No. G5.
  - 2. Lightning and Grounding Systems, Inc.; I-R Series.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Grounding shall be in compliance with NFPA 70 and ANSI C2.
- B. Ground electrical service neutral at service entrance equipment to supplementary grounding electrodes.
- C. Ground each separately derived system neutral to nearest effectively grounded building structural steel member or separate grounding electrode.
- D. Bond together system neutrals, service equipment enclosures, exposed non-current-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.
- E. Shielded Power Cables: Ground shields at each splice or termination in accordance with recommendations of splice or termination manufacturer.
- F. Shielded Control Cables:
  - 1. Ground shield to ground bus at power supply for analog signal.
  - 2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
  - 3. Do not ground control cable shield at more than one point.

### **3.02 WIRE CONNECTIONS**

- A. Ground Conductors: Install in conduit containing power conductors and control circuits above 50 volts.
- B. Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor connected at both ends to non current-carrying grounding bus.
- C. Connect ground conductors to raceway grounding bushings.
- D. Extend and connect ground conductors to ground bus in all equipment containing a ground bus.



- E. Connect enclosure of equipment containing ground bus to that bus.
- F. Bolt connections to equipment ground bus.
- G. Bond grounding conductors to metallic enclosures at each end, and to intermediate metallic enclosures.
- H. Junction Boxes: Furnish materials and connect to equipment grounding system with grounding clips mounted directly on box, or with 3/8-inch machine screws.

### **3.03 MOTOR GROUNDING**

- A. Extend equipment ground bus via grounding conductor installed in motor feeder raceway; connect to motor frame.
- B. Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor connected at both ends to non current-carrying grounding bus.
- C. Motors Less Than 10 hp: Furnish mechanical-type terminal connected to conduit box mounting screw.
- D. Motors 10 hp and Above: Tap motor frame or equipment housing; furnish mechanical-type terminal connected with minimum 5/16-inch brass threaded stud with bolt and washer.
- E. Circuits 20 Amps or Above: Tap motor frame or equipment housing; install solderless terminal with minimum 5/16-inch diameter bolt.

### **3.04 GROUND RODS**

- A. Install full length with conductor connection at upper end.
- B. Install with connection point below finished grade, unless otherwise shown.

### **3.05 GROUNDING WELLS**

- A. Install inside buildings, asphalt, and paved areas.
- B. Install riser ring and cover flush with surface.
- C. Place 9 inches crushed rock in bottom of each well.

### **3.06 CONNECTIONS**

- A. General:
  - 1. Above grade Connections: Use either exothermic weld or mechanical-type connectors.
  - 2. Below grade Connections: Install exothermic weld type connectors.
  - 3. Remove paint, dirt, or other surface coverings at connection points to allow good metal-to-metal contact.
  - 4. Notify Engineer prior to backfilling ground connections.
- B. Exothermic Weld Type:

1. Wire brush or file contact point to bare metal surface.
  2. Use welding cartridges and molds in accordance with manufacturer's recommendations.
  3. Avoid using badly worn molds.
  4. Mold to be completely filled with metal when making welds.
  5. After completed welds have cooled, brush slag from weld area and thoroughly clean joint.
- C. Mechanical Type:
1. Apply homogeneous blend of colloidal copper and rust and corrosion inhibitor before making connection.
  2. Install in accordance with connector manufacturer's recommendations.
  3. Do not conceal mechanical connections.

### **3.07 METAL STRUCTURE GROUNDING**

- A. Ground metal sheathing and exposed metal vertical structural elements to grounding system.
- B. Bond electrical equipment supported by metal platforms to the platforms.
- C. Provide electrical contact between metal frames and railings supporting pushbutton stations, receptacles, and instrument cabinets, and raceways carrying circuits to these devices.

### **3.08 MANHOLE AND HANDHOLE GROUNDING**

- A. Install one ground rod inside each.
- B. Ground Rod Floor Protrusion: 4 to 6 inches above floor.
- C. Make connections of grounding conductors fully visible and accessible.
- D. Connect all non current-carrying metal parts, and any metallic raceway grounding bushings to ground rod with No. 6 AWG copper conductor.

### **3.09 TRANSFORMER GROUNDING**

- A. Bond neutrals of transformers within buildings to system ground network, and to any additional indicated grounding electrodes.
- B. Bond neutrals of substation transformers to substation grounding grid and system grounding network.
- C. Bond neutrals of pad-mounted transformers to four locally driven ground rods and buried ground wire encircling transformer and system ground network.

### **3.10 SURGE PROTECTION EQUIPMENT GROUNDING**

- A. Connect surge arrestor ground terminals to equipment ground bus.

### **3.11 INSTRUMENT GROUND - SURGE SUPPRESSION**

- A. Connect all instrument surge protection with #6 insulated copper ground wire (in conduit where above grade) to closest plant ground system

### **3.12 BONDING**

- A. Bond to Main Conductor System:
  - 1. All roof mounted ventilators, fans, air handlers, masts, flues, cooling towers, handrails, and other sizeable metal objects.
  - 2. Roof flashing, gravel stops, insulation vents, ridge vents, roof drains, soil pipe vents, and other small metal objects if located within 6 feet of main conductors or another grounded object.
  - 3. Provide air terminals as required.
- B. Bond steel columns or major framing members to grounding system per National Electrical Code.
- C. Bond each main down conductor to grounding system.

### **3.13 GROUNDING SYSTEM**

- A. Grounding Conductor:
  - 1. Completely encircle building structure.
  - 2. Bury minimum 30" below finished grade.
  - 3. Minimum 2 feet distance from foundation walls.
- B. Interconnect ground rods by direct-buried copper cables.
- C. Connections:
  - 1. Install ground cables continuous between connections.
  - 2. Exothermic welded connections to ground rods, cable trays, structural steel, handrails, and buried and nonaccessible connections.
  - 3. Provide bolted clamp type mechanical connectors for all exposed secondary connections.
  - 4. Use bolted offset parapet bases or through-roof concealed base assemblies for air terminal connections.
  - 5. Provide interconnections with electrical and telephone systems and all underground water and metal pipes.
  - 6. Provide electric service arrestor ground wire to building water main.

### **3.14 FIELD QUALITY CONTROL**

- A. As specified in Section 26 08 00, Electrical Testing.

END OF SECTION



## SECTION 26\_05\_33

### RACEWAYS

#### PART 1 GENERAL

##### 1.01 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO): Division I, Standard Specifications for Highway Bridges, Fourteenth Edition.
  2. American National Standards Institute (ANSI):
    - a. C80.1, Rigid Steel Conduit-Zinc Coated.
    - b. C80.3, Electrical Metallic Tubing-Zinc Coated.
    - c. CS0.5, Rigid Aluminum Conduit.
    - d. C80.6, Intermediate Metal Conduit (IMC)-Zinc Coated.
  3. American Society for Testing and Materials (ASTM):
    - a. A123 EI, Standard Specification for Zinc-Coated (Galvanized) Coatings on Iron and Steel Products.
    - b. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
  4. National Electrical Contractor's Association, Inc. (NECA): 5055, Standard of Installation.
  5. National Electrical Manufacturers Association (NEMA):
    - a. RN 1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
    - b. TC 2, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
    - c. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
    - d. TC 6, PVC and ABS Plastic Utilities Duct for Underground Installation.
    - e. VE 1, Metallic Cable Tray Systems.
  6. National Fire Protection Association (NFPA): 70, National Electrical Code. (NEC)
  7. Underwriters Laboratories, Inc. (UL):
    - a. 1, Standard for Safety Flexible Metal Conduit.
    - b. 6, Standard for Safety Rigid Metal Conduit.
    - c. 360, Standard for Safety Liquid-Tight Flexible Steel Conduit.
    - d. 514B, Standard for Safety Fittings for Conduit and Outlet Boxes.
    - e. 514C, Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
    - f. 651, Standard for Safety Schedule 40 and 80 PVC Conduit.
    - g. 651A, Standard for Safety Type EB and Rigid PVC Conduit and HDPF Conduit.
    - h. 797, Standard for Safety Electrical Metallic Tubing.
    - i. 870, Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings.
    - j. 1242, Standard for Safety Intermediate Metal Conduit.

- k. 1660, Standard for Safety Liquid-Tight Flexible Nonmetallic Conduit.

## **1.02 SUBMITTALS**

- A. Shop Drawings:
  - 1. Manufacturer's Literature:
    - a. Rigid galvanized steel conduit.
    - b. Electric metallic tubing.
    - c. Rigid aluminum conduit.
    - d. PVC Schedule 40 conduit.
    - e. PVC-coated rigid galvanized steel conduit.
    - f. Flexible metal, liquid-tight conduit.
    - g. Flexible, nonmetallic, liquid-tight conduit.
    - h. Conduit fittings.
    - i. Wireways.
  - 2. Precast Manholes and Handholes:
    - a. Dimensional drawings and descriptive literature.
    - b. Traffic loading calculations.
    - c. Accessory information.
  - 3. Cable Tray Systems:
    - a. Dimensional drawings, calculations, and descriptive information.
    - b. NEMA load/span designation and how it was selected.
    - c. Support span length and pounds-per-foot actual and future cable loading at locations, with safety factor used.
    - d. Location and magnitude of maximum simple beam deflection of tray for loading specified.
    - e. Layout drawings and list of accessories being provided.
  - 4. Conduit Layout:
    - a. Plan and section type, showing arrangement and location of conduit and duct bank required for:
      - 1) Low and medium voltage feeder and branch circuits.
      - 2) Instrumentation and control systems.
      - 3) Communications systems.
      - 4) Empty conduit for future use.
    - b. Reproducible drawings; scale not greater than 1 inch equals 20 feet.
      - 1) Equipment and machinery proposed for bending metal conduit.
      - 2) Method for bending PVC conduit less than 30 degrees.

## **1.03 UL COMPLIANCE**

- A. Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.

## **PART 2 PRODUCTS**

### **2.01 CONDUIT AND TUBING**

- A. Rigid Galvanized Steel Conduit (RGS):
  - 1. Meet requirements of ANSI C80.1 and UL6.

2. Material: Hot-dip galvanized, with chromated protective layer.
- B. Electric Metallic Tubing (EMT):
1. Meet requirements of ANSI C80.3 and UL 797.
  2. Material: Hot-dip galvanized, with chromated and lacquered protective layer.
- C. Rigid Aluminum Conduit:
1. Meet requirements of ANSI C80.5 and UL 6.
  2. Material: Type 6063, copper-free aluminum alloy.
- D. PVC Schedule 40 Conduit:
1. Meet requirements of NEMA TC 2 and UL 651.
  2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.
- E. PVC-Coated Rigid Galvanized Steel Conduit:
1. Meet requirements of NEMA RN 1.
  2. Material:
    - a. Conduit: Meet requirements of ANSI C80.1 and UL 6
    - b. PVC Coating: 40 mils nominal thickness, bonded to metal.
- F. Flexible Metal, Liquid-Tight Conduit:
1. UL 360 listed for 105 degrees C insulated conductors.
  2. Material: Galvanized steel, with an extruded PVC jacket.
- G. Flexible, Nonmetallic, Liquid-Tight Conduit:
1. Material: PVC core with fused flexible PVC jacket.
  2. UL 1660 listed for:
    - a. Dry Conditions: 80 degrees C insulated conductors.
    - b. Wet Conditions: 60 degrees C insulated conductors.
  3. Manufacturers:
    - a. Carlon; Carflex or X-Flex.
    - b. T & B; Xtraflex LTC or EFC.

## 2.02 FITTINGS

- A. Rigid Galvanized Steel Conduit:
1. General:
    - a. Meet requirements of UL 514B.
    - b. Type: Threaded, galvanized. Set screw fittings not permitted.
  2. Bushing:
    - a. Material: Malleable iron with integral insulated throat, rated for 150 degrees C.
    - b. Manufacturers:
      - 1) Thomas & Betts; Type BIM.
      - 2) O.Z./Gedney; Type HB.
  3. Grounding Bushing:
    - a. Material: Malleable iron with integral insulated throat rated for 150 degrees C, with solderless lugs.
    - b. Manufacturers:
      - 1) Appleton; Series GIB.

- 2) O.Z. Gedney; Type HBLG.
- 4. Conduit Hub:
  - a. Material: Malleable iron with insulated throat.
  - b. Manufacturers:
    - 1) O.Z. Gedney; Series CH.
    - 2) T & B; Series 370.
- 5. Conduit Bodies:
  - a. Material: Malleable iron, sized as required by NFPA 70.
  - b. Manufacturers (For Normal Conditions):
    - 1) Appleton; Form 35 threaded Unilets.
    - 2) Crouse-Hinds; Form 7 or 8 threaded condulets.
    - 3) Killark; Series O Electrolets.
  - c. Manufacturers (For Hazardous Locations):
    - 1) Appleton.
    - 2) Crouse-Hinds.
    - 3) Killark.
- 6. Couplings: As supplied by conduit manufacturer.
- 7. Conduit Sealing Fitting Manufacturers:
  - a. Appleton; Type EYF, EYM, or ESU.
  - b. Crouse-Hinds; Type EYS or EZS.
  - c. Killark; Type EY or EYS.
- 8. Drain Seal Manufacturers:
  - a. Appleton; Type SF.
  - b. Crouse-Hinds; Type EYD or EZD.
- 9. Drain/Breather Fitting Manufacturers:
  - a. Appleton; Type ECDB.
  - b. Crouse-Hinds; ECD.
- 10. Expansion Fitting Manufacturers:
  - a. Deflection/Expansion Movement:
    - 1) Appleton; Type DF.
    - 2) Crouse-Hinds; Type XD.
  - b. Expansion Movement Only:
    - 1) Appleton; Type XJ.
    - 2) Crouse-Hinds; Type XJ.
- 11. Cable Sealing Fittings:
  - a. To form watertight non-slip cord or cable connection to conduit.
  - b. For Conductors With OD of 1/2 Inch or Less: Neoprene bushing at connector entry.
  - c. Manufacturers:
    - 1) Crouse-Hinds; CGBS.
    - 2) Appleton; CG-S.

- B. Electric Metallic Tubing:
  - 1. Meet requirements of UL 514B.
  - 2. Type: Steel body and locknuts with steel or malleable iron compression nuts. Set screw and drive-on fittings not permitted.
  - 3. Compression Ring: Stainless steel.
  - 4. Coupling Manufacturers:
    - a. Appleton; Type 95T.
    - b. Crouse-Hinds; Type CPR.
  - 5. Connector Manufacturers:
    - a. Appleton; Type 86T.



- b. Crouse-Hinds; Type CPR.
- C. Rigid Aluminum Conduit:
- 1. General:
    - a. Meet requirements of UL 514B.
    - b. Type: Threaded, copper-free. Set screw fittings not permitted.
  - 2. Insulated Bushing:
    - a. Material: Cast aluminum, with integral insulated throat, rated for 150 degrees C.
    - b. Manufacturer: O.Z. Gedney; Type AB.
  - 3. Grounding Bushing:
    - a. Material: Cast aluminum with integral insulated throat, rated for 150 degrees, with solderless lugs.
    - b. Manufacturer: O.Z. Gedney; Type ABLG.
  - 4. Conduit Hub:
    - a. Material: Cast aluminum, with insulated throat.
    - b. Manufacturers:
      - 1) O.Z. Gedney; Type CHA.
      - 2) T & B; Series 370AL.
  - 5. Conduit Bodies:
    - a. Manufacturers (For Normal Conditions):
      - 1) Appleton; Form 85 threaded Unilets.
      - 2) Crouse-Hinds; Mark 9 or Form 7-SA threaded condulets.
      - 3) Killark; Series O Electrolets.
    - b. Manufacturers (For Hazardous Locations):
      - 1) Appleton.
      - 2) Crouse-Hinds.
      - 3) Killark.
  - 6. Couplings: As supplied by conduit manufacturer.
  - 7. Conduit Sealing Fitting Manufacturers:
    - a. Appleton; Type EYF-AL or EYM-AL.
    - b. Crouse-Hinds; Type EYS-SA or EZS-SA.
    - c. Killark; Type EY or EYS.
  - 8. Drain Seal Manufacturers:
    - a. Appleton; Type EYDM-A.
    - b. Crouse-Hinds; Type EYD-SA or EZD-SA.
  - 9. Drain/Breather Fitting Manufacturers:
    - a. Appleton; Type ECDB.
    - b. Crouse-Hinds; ECD.
  - 10. Expansion Fitting Manufacturers:
    - a. Deflection/Expansion Movement: Steel City; Type DF-A.
    - b. Expansion Movement Only: Steel City; Type AF-A.
  - 11. Cable Sealing Fittings: To form watertight non-slip cord or cable connection to conduit.
    - a. Bushing: Neoprene at connector entry.
    - b. Manufacturer: Appleton CG-S.
- D. PVC Conduit and Tubing:
- 1. Meet requirements of NEMA TC-3.
  - 2. Type: PVC, slip-on.
- E. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of UL 514B.
  2. Type: Rigid galvanized steel, PVC coated by conduit manufacturer.
  3. Overlapping pressure sealing sleeves.
  4. Conduit Hangers, Attachments, and Accessories: PVC-coated.
- F. Flexible Metal, Liquid-Tight Conduit:
1. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
  2. Insulated throat and sealing O-rings.
  3. Long design type extending outside of box or other device at least 2 inches.
    - a. Manufacturer: T & B; Series 5300.
- G. Flexible, Nonmetallic, Liquid-Tight Conduit: Meet requirements of UL 514B.
1. Type: One-piece fitting body, complete with lock nut, O-ring, threaded ferrule, sealing ring, and compression nut.
  2. Manufacturers:
    - a. Carlon; Type LT.
    - b. Kellems; Polytuff.
    - c. T & B; LT Series.
- H. Watertight Entrance Seal Device:
1. New Construction:
    - a. Material: Oversized sleeve, malleable iron body with sealing ring, pressure ring, grommet seal, and pressure clamp.
    - b. Manufacturer: O.Z./Gedney; Type FSK or WSK, as required.
  2. Gored-Hole Application:
    - a. Material: Assembled dual pressure disks, neoprene sealing ring, and membrane clamp.
    - b. Manufacturer: O.Z./Gedney; Series CSM.
- I. Hazardous Locations: Approved for use in the atmosphere involved.
1. Manufacturer: Crouse-Hinds; Type ECGJH.
- J. Corrosive Locations:
1. Material: 40-mil PVC-coated rigid steel.
  2. Manufacturers:
    - a. Robroy Industries.
    - b. Carlon.
    - c. Crouse-Hinds.

### **2.03 WIREWAYS**

- A. Meet requirements of UL 870.
- B. Type: Steel-enclosed, with removable, hinged cover.
- C. Rating: Outdoor rain-tight if outdoor, and indoor if indoor.
- D. Finish: Gray, baked enamel.
- E. Manufacturers:
  1. Square D.

2. B-Line Systems, Inc.

## **2.04 CABLE TRAYS**

- A. Meet requirements of NEMA VE 1.
- B. Type: Ladder of welded construction with six inch side rails.
- C. Material: Copper-free aluminum alloy 6063-T6 finish.
- D. Barrier Strip: Vertical, solid type, with horizontal fittings and strip clamps.
- E. Fittings of same cross-sectional tray area, and hardware of same material as cable tray.
- F. Tray Grounding: Conform to NFPA 70 and NEMA VE 1.
- G. Provide next higher NEMA VE 1 class designation than required for support of designed span length.
- H. Design Loads: Use working load adequate for actual cable installed plus 50 percent additional weight allowance for future cables plus 200-pound concentrated static load applied between side rails at midspan, with safety factor of 2 in accordance with NEMA VE 1, Table 3-1.
- I. Expansion Joints: NEMA VE 1 for 50 degrees F maximum temperature variation.
- J. Furnish Cable Tray with no sharp edges, burrs, or weld projections.
- K. Manufacturers:
  1. B-Line Systems, Inc.
  2. Square-D.
  3. Cope

## **2.05 PRECAST MANHOLES AND HANDHOLES**

- A. Concrete Strength: Minimum, 3,000 psi compressive, in 28 days.
- B. Loading: AASHTO Division 1, H-20 in accordance with ASTM C857.
- C. Access: Provide cast concrete 6- or 12-inch risers and access hole adapters between top of manhole and finished grade at required elevations.
- D. Drainage:
  1. Slope floors toward drain points, leaving no pockets or other non-draining areas.
  2. Provide drainage outlet or sump at low point of floor constructed with a heavy, cast iron, slotted or perforated hinged cover, and 4-inch minimum outlet and outlet pipe.
- E. Raceway Entrances:
  1. Provide on all four sides.

2. For raceways to be installed under this Contract, provide knockout panels or precast individual raceway openings.
  3. At entrances where raceways are to be installed by others, provide minimum 12-inch high by 24-inch wide knockout panels for future raceway installation.
- F. Embedded Pulling Iron:
1. Material: 3/4-inch diameter stock, fastened to overall steel reinforcement before concrete is placed.
  2. Location:
    - a. Wall: Opposite each raceway entrance and knockout panel for future raceway entrance.
  3. Floor: Centered below manhole or handhole cover.
- G. Cable Racks:
1. Arms and Insulators: Adjustable, of sufficient number to accommodate cables for each raceway entering or leaving manhole, including spares.
  2. Wall Attachment:
    - a. Adjustable inserts in concrete walls. Bolts or embedded studs not permitted.
    - b. Insert Spacing: Maximum 3-foot on center entire inside perimeter of manhole.
    - c. Arrange so that spare raceway ends are clear for future cable installation.
- H. Manhole Frames and Covers:
1. Material: Machined cast iron.
  2. Diameter: 32 inches.
  3. Cover Type: Indented, solid top design, with two drop handles each.
  4. Cover Loading: AASHTO Division I, H-20.
  5. Cover Designation: Cast, on upper side, in integral letters, minimum 2 inches in height, appropriate titles:
    - a. Above 600 Volts: ELECTRIC HV.
    - b. 600 Volts and Below: ELECTRIC LV.
    - c. TELEPHONE.
    - d. Instrumentation: SIGNAL
- I. Manhole /Handhole Frames and Covers:
1. Material: Steel, hot-dipped galvanized.
  2. Cover Type: Solid, bolt-on, of checkered design.
  3. Cover Loading: H-20.
  4. Cover Designation: Burn by welder, on upper side in integral letters, minimum 2 inches in height, appropriate titles:
    - a. 600 Volts and Below: ELECTRIC LV.
    - b. TELEPHONE.
- J. Hardware: Steel, hot-dip galvanized.
- K. Furnish knockout for ground rod in each handhole and manhole.
- L. Manufacturers:
1. U.S. Precast.
  2. Brooks Products, Inc.

3. Penn-Cast Products, Inc.
4. Concrete Conduit Co.
5. Associated Concrete Products, Inc.
6. Utility Vault Co.
7. Pipe, Inc.

## 2.06 ACCESSORIES

- A. Duct Bank Spacers:
  1. Type: Nonmetallic, interlocking, for multiple conduit sizes.
  2. Suitable for all types of conduit.
  3. Manufacturer: Underground Device, Inc.; Type WUNPEECE.
  
- B. Identification Devices:
  1. Raceway Tags:
    - a. Material: Permanent, nylon.
    - b. Shape: Round.
    - c. Raceway Designation: Pressure stamped, embossed, or engraved.
    - d. Tags relying on adhesives or taped-on markers not permitted.
  2. Warning Tape:
    - a. Material: Polyethylene, 4-mil gauge.
    - b. Color: Red.
    - c. Width: Minimum 6-inch.
    - d. Designation: Warning on tape that electric circuit is located below tape.
    - e. Manufacturers:
      - 1) Blackburn, Type RT.
      - 2) Griffolyn Co.
  3. Buried Raceway Marker:
    - a. Material: Sheet bronze, consisting of double-ended arrows, straight for straight runs and bent at locations where runs change direction runs.
    - b. Designation: Incise to depth of 3/32 inch, ELECTRIC CABLES. in letters 1/4-inch high.
    - c. Minimum Dimension: 1/4-inch thick, 10 inches long, and 3/4-inch wide.
  
- C. Raceway Coating:
  1. Material: Bitumastic or plastic tape coating.
  2. Manufacturers:
    - a. Koppers bitumastic; No. 505.
    - b. Scotchwrap; No. 51, plastic tape.
  
- D. Wraparound Duct Band:
  1. Material: Heat-shrinkable, cross-linked polyolefin, pre-coated with hot-melt adhesive.
  2. Manufacturer: Raychem; Type TWDB.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Conduit and Tubing sizes shown are based on the use of copper conductors. Reference Section 06 05 05, Conductors, concerning conduit sizing for aluminum conductors.
- B. All installed Work shall comply with NECA 5055.
- C. Crushed or deformed raceways not permitted.
- D. Maintain raceway entirely free of obstructions and moisture.
- E. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
- F. Aluminum Conduit: Do not install in direct contact with concrete.
- G. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
- H. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.
- I. Group raceways installed in same area.
- J. Proximity to Heated Piping: Install raceways minimum 12 inches from parallel runs.
- K. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
- L. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.
- M. Block Walls: Do not install raceways in same horizontal course with reinforcing steel.
- N. Install watertight fittings in outdoor, underground, or wet locations.
- O. Paint threads, before assembly of fittings, of galvanized conduit or IMC installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.
- P. All metal conduit to be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.
- Q. Do not install raceways in concrete equipment pads, foundations, or beams.
- R. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.

- S. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.
- T. All hardware associated with conduit fittings shall be stainless steel or brass.
- U. All conduits shall be tagged at both ends with a two color (black/white) hard plastic engraved tag. Tag number shall correspond to that called out in the conduit schedule.
- V. All underground conduits shall be PVC.
- W. All HORIZONTAL conduits run above grade shall be aluminum instead PVC, whether they are mounted on deck or on a wall, Vertical conduit runs above grade can remain PVC.
- X. All conduit straps shall be 3316 stainless steel.
- Y. Each conduit run shall at minimum have one spare conduit. All spare conduits shall have pull string installed in them and be capped.
- Z. Each wire pull within a conduit shall at minimum have to spare wires. Each and every conduit shall at minimum contain a #12 AWG ground wire.
- AA. Each conduit entrance into an open space shall be duct sealed. Do NOT foam pipes.
- BB. Only use non-metallic screw on type carflex. Never use push on type carflex.
- CC. No carflex run shall be longer the 6 ft, irregardless of the amount of strapping.

### **3.02 INSTALLATION IN CAST-IN-PLACE STRUCTURAL CONCRETE**

- A. Minimum cover 1-1/2 inches.
- B. Provide support during placement of concrete to ensure raceways remain in position.
- C. Floor Slabs:
  - 1. Outside diameter of conduit not to exceed one-third of the slab thickness.
  - 2. Separate conduit by minimum six times conduit outside diameter, except at crossings.

### **3.03 CONDUIT APPLICATION**

- A. Diameter: Minimum 3/4 inch.
- B. Exterior, Exposed:
  - 1. Rigid galvanized steel
  - 2. PVC Schedule 40 (see 3.01.W)
- C. Interior, Exposed:

1. Rigid galvanized steel.
  2. Electric metallic tubing for ceiling portion of lighting circuits in a conditioned environment.
  3. PVC Schedule 40 (see 3.01.W)
- D. Interior, Concealed (Not Embedded in Concrete):
1. Rigid galvanized steel.
  2. PVC Schedule 40 for frame walls. (see 3.01.W)
- E. Aboveground, Embedded in Concrete Walls, Ceilings, or Floors: PVC Schedule 40.
- F. Direct Earth Burial: PVC Schedule 80.
- G. Concrete-Encased Raceways: PVC Schedule 40.
- H. Under Slabs-On-Grade: PVC Schedule 40.
- I. Corrosive Areas, Exterior: PVC-coated rigid galvanized steel.
- J. Corrosive Areas, Interior: PVC Schedule 80.
- K. Conduits between VFDs and motors PVC schedule 40 conduit for armored cable (inside and outside).
- L. Lightning Protection: PVC Schedule 40.

### **3.04 CONNECTIONS**

- A. For motors, wall or ceiling mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other equipment where flexible connection is required to minimize vibration:
1. Conduit Size 4 Inches or Less: Flexible metal, liquid-tight conduit.
  2. Conduit Size Over 4 Inches: Nonflexible.
  3. Corrosive Areas: Flexible, nonmetallic, liquid or PVC-coated metallic, liquid-tight.
  4. Length: 18-inch minimum, 60-inch maximum, of sufficient length to allow movement or adjustment of equipment.
- B. Lighting Fixtures in Dry Areas: Flexible steel, non-liquid-tight conduit.
- C. Outdoor Areas, Process Areas Exposed to Moisture, and Areas Required to be Oiltight and Dust-Tight: Flexible metal, liquid-tight conduit.
- D. Transition From Underground or Concrete Embedded to Exposed: PVC Coated Rigid galvanized steel conduit.
- E. Under Equipment Mounting Pads: Rigid galvanized steel conduit.
- F. Exterior Light Pole Foundations: Rigid galvanized steel conduit.



### 3.05 PENETRATIONS

- A. Make at right angles, unless otherwise shown.
- B. Notching or penetration of structural members, including footings and beams, not permitted.
- C. Fire-Rated Walls, Floors, or Ceilings: Fire-stop openings around penetrations to maintain fire-resistance rating.
- D. Apply single layer of wraparound duct band to all metallic conduit in contact with concrete floor slabs to a point 2 inches above concrete surface.
- E. Concrete Walls, Floors, or Ceilings (Aboveground): Provide non-shrink grout dry-pack, or use watertight seal device.
- F. Entering Structures:
  - 1. Seal raceway at the first box or outlet with minimum 2 inches thick expandable plastic compound to prevent the entrance of gases or liquids from one area to another.
  - 2. Concrete Roof or Membrane Waterproofed Wall or Floor:
    - a. Provide a watertight seal.
    - b. Without Concrete Encasement: Install watertight entrance seal device on each side.
    - c. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
    - d. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
    - e. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
  - 3. Heating, Ventilating, and Air Conditioning Equipment:
    - a. Penetrate equipment in area established by manufacturer.
    - b. Terminate conduit with flexible metal conduit at junction box or conduit attached to exterior surface of equipment prior to penetrating equipment.
    - c. Seal penetration with silicone type sealant.
  - 4. Corrosive-Sensitive Areas:
    - a. Seal all conduit passing through chlorine and ammonia room walls.
    - b. Seal all conduit entering equipment panel boards and field panels containing electronic equipment.
    - c. Seal penetration with silicone type sealant.
  - 5. Existing or Precast Wall (Underground): Core drill wall and install a watertight entrance seal device.
  - 6. Non-waterproofed Wall or Floor (Underground, without Concrete Encasement):
    - a. Provide Schedule 40 galvanized pipe sleeve, or watertight entrance seal device.
    - b. Fill space between raceway and sleeve with an expandable plastic compound on each side.
  - 7. Manholes and Pullboxes:
    - a. Metallic Raceways: Provide insulated grounding bushings.

- b. Nonmetallic Raceways: Provide bell ends flush with wall.
- c. Install such that raceways enter as near as possible to one end of wall, unless otherwise shown.

### **3.06 SUPPORT**

- A. Support from structural members only, at intervals not exceeding NFPA 70 requirements, and in any case not exceeding 10 feet. Do not support from piping, pipe supports, or other raceways.
- B. Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit, allow 40 percent extra space for future conduit.
- C. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:
  - 1. Wood: Wood screws.
  - 2. Hollow Masonry Units: Toggle bolts.
  - 3. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
  - 4. Steelwork: Machine screws.
- D. Nails or wooden plugs inserted in concrete or masonry for attaching raceway not permitted. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

### **3.07 BENDS**

- A. Install concealed raceways with a minimum of bends in the shortest practical distance.
- B. Make bends and offsets of longest practical radius.
- C. Install with symmetrical bends or cast metal fittings.
- D. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.
- E. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.
- F. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run, and raceways are same size.
- G. PVC Conduit:
  - 1. Bends 30-Degree and Larger: Provide factory-made elbows.
  - 2. 90-Degree Bends: Provide rigid steel elbows.
  - 3. Use manufacturer's recommended method for forming smaller bends.
- H. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

### **3.08 EXPANSION/DEFLECTION FITTINGS**

- A. Provide on all raceways at all structural expansion joints, and in long tangential runs.
- B. Provide expansion/deflection joints for 50 degrees F maximum temperature variation.
- C. Install in accordance with manufacturer's instructions.

### **3.09 PVC CONDUIT**

- A. Solvent Welding:
  - 1. Provide manufacturer recommended solvent; apply to all joints.
  - 2. Install such that joint is watertight.
- B. Adapters:
  - 1. PVC to Metallic Fittings: PVC terminal type.
  - 2. PVC to Rigid Metal Conduit or IMC: PVC female adapter.
- C. Beveled-End Conduit: Bevel the un-belled end of the joint prior to joining.

### **3.10 PVC-COATED RIGID STEEL CONDUIT**

- A. Install in accordance with manufacturer's instructions.
- B. Provide PVC boot to cover all exposed threading.

### **3.11 WIREWAYS**

- A. Install in accordance with manufacturer's instructions.
- B. Locate with cover on accessible vertical face of wireway, unless otherwise shown.
- C. Any electrical trough located in a continuously climate controlled environment can be constructed of painted carbon steel.
- D. Any electrical trough NOT located in continuously climate controlled environment shall be constructed of aluminum or 316 stainless steel.
- E. Electrical troughs to be provided with continuous hinged door with drip lip. Do NOT provide flush mounted screw down fronts
- F. All electrical troughs shall be tagged with a two color (black / white) hard plastic engraved tag.

### **3.12 CABLE TRAYS**

- A. Install in accordance with Application Information Section of NEMA VE 1.
- B. Provide accessories as necessary for a complete system.

- C. Install such that joints are not made at support brackets.
- D. Install horizontal section support brackets between support point and quarter point of tray span.
- E. Provide ceiling trapeze for all horizontal cable tray.
- F. Install support within 2 feet on each side of expansion joints and within 2 feet of fitting extremity.
- G. Provide expansion joints in accordance with NEMA VE 1 for 50 degrees F maximum temperature variation.
- H. Install horizontal tray level, plumb, straight, and true to line or grade within a tolerance of 1/8 inch in 10 feet and within a cumulative maximum of 1/2 inch.
- I. Install vertical tray plumb within a tolerance of 1/8 inch in 10 feet.
- J. Install without exposed raw edges.
- K. Maintain 9-inch minimum vertical separation between multi-tiered trays having a common support, and at all crossover locations.
- L. Provide bonding jumper at each expansion joint and adjustable connection.
- M. Ground Conductor: Provide properly sized clamps for each section, elbow, tee, cross, and reducer.

### **3.13 TERMINATION AT ENCLOSURES**

- A. Cast Metal Enclosure: Provide manufacturer's pre-molded insulating sleeve inside metallic conduit terminating in threaded hubs.
- B. Sheet Metal Boxes, Cabinets, and Enclosures:
  - 1. Rigid Galvanized Conduit:
    - a. Provide one lock nut each on inside and outside of enclosure.
    - b. Install grounding bushing.
    - c. Provide bonding jumper from grounding bushing to equipment ground bus or ground pad; if neither ground bus nor pad exists, connect jumper to lag bolt attached to metal enclosure.
    - d. Install insulated bushing on ends of conduit where grounding is not required.
    - e. Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
  - 2. Electric Metallic Tubing: Provide gland compression, insulated connectors.
  - 3. Flexible Metal Conduit: Provide two screw type, insulated, malleable iron connectors.
  - 4. Flexible, Nonmetallic Conduit: Provide nonmetallic, liquid-tight strain relief connectors.
  - 5. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.
  - 6. PVC Schedule 40 Conduit: Provide PVC terminal adapter with lock nut.

- C. Motor Control Center, Switchboard, Switchgear, and Free-Standing Enclosures: Terminate conduit entering bottom with grounding bushing; provide a grounding jumper extending to equipment ground bus or grounding pad.

### **3.14 UNDERGROUND RACEWAYS**

- A. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.
- B. Cover: Maintain minimum 2-foot cover above conduit and concrete encasement, unless otherwise shown.
- C. Make routing changes as necessary to avoid obstructions or conflicts.
- D. Couplings: In multiple conduit runs, stagger so that couplings in adjacent runs are not in same transverse line.
- E. Union type fittings not permitted.
- F. Spacers:
  - 1. Provide preformed, nonmetallic spacers, designed for such purpose, to secure and separate parallel conduit runs in a trench or concrete encasement.
  - 2. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.
- G. Support conduit so as to prevent bending or displacement during backfilling or concrete placement.
- H. Installation with Other Piping Systems:
  - 1. Crossings: Maintain minimum 12-inch vertical separation.
  - 2. Parallel Runs: Maintain minimum 12-inch separation.
  - 3. Installation over valves or couplings not permitted.
- I. Metallic Raceway Coating: At couplings and joints and along entire length, apply wraparound duct band with one-half tape width overlap to obtain two complete layers.
- J. Concrete Encasement:
  - 1. Concrete Color: Gray, dust top of concrete ductbank with powdered red concrete dye before concrete sets and trowel dry onto top of ductbank.
- K. Backfill:
  - 1. Do not backfill until inspected by Engineer.

### **3.15 MANHOLES AND HANDHOLES**

- A. Excavate, shore, brace, backfill, and final grade back to original state.
- B. Do not install until final raceway grading has been determined.

- C. Install such that raceways enter at nearly right angles and as near as possible to one end of wall, unless otherwise shown.
- D. Grounding: As specified in Section 26 05 26, Grounding.
- E. Identification: Field stamp covers with manhole or handhole number as shown. Stamped numbers to be 1-inch minimum height.

### **3.16 EMPTY RACEWAYS**

- A. Provide permanent, removable cap over each end.
- B. Provide PVC plug with pull tab for underground raceways with end bells.
- C. Provide nylon pull cord.
- D. Identify, as specified in Paragraph Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

### **3.17 IDENTIFICATION DEVICES**

- A. Raceway Tags:
  - 1. Identify origin and destination.
  - 2. Install at each terminus, near midpoint, and at minimum intervals of every 50 feet of exposed Raceway, whether in ceiling space or surface mounted.
  - 3. Provide nylon strap for attachment.
  - 4. A conduit schedule shall be created. Shall at a minimum call out the tag number for the conduit, the two locations that the conduit connects together, and wire count within the conduit.
  - 5. All conduits shall be tagged at both ends with two color (black/white) hard plastic engraved tag. Tag number shall correspond to that called out in the conduit schedule.
- B. Tags shall be connected to conduits with the use of UV resistant cable ties. Warning Tape: Install approximately 12 inches above underground or concrete-encased raceways. Align parallel to, and within 12 inches of, centerline of runs.
- C. Buried Raceway Markers:
  - 1. Install at grade to indicate direction of underground raceways.
  - 2. Install at all bends and at intervals not exceeding 100 feet in straight runs.
  - 3. Embed and secure to top of concrete base, sized 14 inches long, 6 inches wide, and 8 inches deep; top set flush with finished grade.

### **3.18 PROTECTION OF INSTALLED WORK**

- A. Protect products from effects of moisture, corrosion, and physical damage during construction.
- B. Provide and maintain manufactured watertight and dust-tight seals over all conduit openings during construction.

- C. Touch up painted conduit threads after assembly to cover nicks or scars.
- D. Touch up damage to coating on PVC-coated conduit with patching compound approved by manufacturer.

END OF SECTION

## SECTION 26\_20\_00

### ELECTRICAL MOTORS

#### PART 1 GENERAL

##### 1.01 RELATED SECTIONS

- A. This section applies only when referenced by a motor-driven equipment specification. Application, horsepower, enclosure type, mounting, shaft type, synchronous speed, and any deviations from this section will be listed in the equipment specification. Where such deviations occur, they shall take precedence over this section.

##### 1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
  1. Anti-Friction Bearing Manufacturers' Association (AFBMA):
    - a. 9, Load Ratings and Fatigue Life for Ball Bearings.
    - b. 11, Load Rating and Fatigue Life for Roller Bearings.
  2. American National Standards Institute (ANSI): C50.41, Polyphase Induction Motors for Power Generating Stations.
  3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. 85, Test Procedure for Airborne Sound Measurements on Rotating Machines.
    - b. 112, Standard Test Procedures for Polyphase Induction Motors and Generators.
    - c. 114, Standard Test Procedures for Single-Phase Induction Motors.
    - d. 620, Guide for Construction and Interpretation of Thermal Limit Curves for Squirrel-Cage Motors Over 500 Horsepower.
    - e. 841, Recommended Practice for Chemical Industry Severe-Duty Squirrel-Cage Induction Motors, 600V and Below.
  4. National Electrical Manufacturers Association (NEMA):
    - a. MG 1, Motors and Generators.
    - b. MG 13, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.
    - c. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
  5. National Fire Protection Association (NFPA): 70, National Electrical Code. (NEC)
  6. Underwriters Laboratories (UL):
    - a. 547, Thermal Protectors for Electric Motors.
    - b. 674, Electric Motors and Generators Used in Hazardous (Classified) Locations.

##### 1.03 DEFINITIONS

- A. CISD-TEFC: Chemical industry, severe-duty enclosure.
- B. DIP: Dust-ignition-proof enclosure.



- C. EXP: Explosion-proof enclosure.
- D. ODP: Open drip-proof enclosure.
- E. TEFC: Totally enclosed, fan cooled enclosure.
- F. TENV: Totally enclosed, nonventilated enclosure.
- G. WPI: Open weather protected enclosure, Type I.
- H. WPII: Open weather protected enclosure, Type II.
- I. Motor Nameplate Horsepower: That rating after any derating required to allow for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

#### **1.04 SUBMITTALS**

- A. Shop Drawings:
  - 1. Descriptive information.
  - 2. Nameplate data in accordance with NEMA MG 1.
  - 3. Additional Rating Information:
    - a. Service factor.
    - b. Locked rotor current.
    - c. No load current.
    - d. Safe stall time for motors 200 horsepower and larger.
    - e. Multispeed load classification (e.g., variable torque).
    - f. Adjustable frequency drive motor load classification (e.g., variable torque) and minimum allowable motor speed for that load classification.
  - 4. Enclosure type and mounting (e.g. horizontal, vertical).
  - 5. Dimensions and total weight.
  - 6. Conduit box dimensions and usable volume as defined in NEMA MG 1 and NFPA 70.
  - 7. Bearing type.
  - 8. Bearing lubrication.
  - 9. Bearing life.
  - 10. Space heater voltage and watts.
  - 11. Description and rating of motor thermal protection.
  - 12. Motor sound power level in accordance with NEMA MG 1.
  - 13. Maximum brake horsepower required by the equipment driven by the motor.
  - 14. Description and rating of submersible motor moisture sensing system.
- B. Quality Control Submittals:
  - 1. Factory test reports, certified.
  - 2. Manufacturer's Certificate of Proper Installation, 100 horsepower and larger.
  - 3. Operation and Maintenance Manual.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. General Electric.

- B. Reliance.
- C. MagneTek.
- D. Siemens.
- E. Balder.
- F. U.S Motors.
- G. Westinghouse.
- H. Toshiba.

## **2.02 GENERAL**

- A. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.
- B. In order to obtain single source responsibility, utilize a single supplier to provide a drive motor, its driven equipment, and specified motor accessories.
- C. Meet requirements of NEMA MG 1.
- D. Frame assignments in accordance with NEMA MG 13.
- E. Provide motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.
- F. Motors shall be specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.
- G. Lifting lugs on all motors weighing 100 pounds or more.
- H. Operating Conditions:
  - 1. Maximum ambient temperature not greater than 50 degrees C.
  - 2. Motors shall be suitable for operating conditions without any reduction being required in the nameplate rated horsepower or exceeding the rated temperature rise.
  - 3. Overspeed in either direction in accordance with NEMA MG 1.

## **2.03 HORSEPOWER RATING**

- A. As designated in motor-driven equipment specifications.
- B. Constant Speed Applications: Brake horsepower of the driven equipment at any head capacity point on the pump curve not to exceed motor nameplate horsepower rating, excluding any service factor.
- C. Adjustable Frequency, Adjustable Speed Applications: Driven equipment brake horsepower at any head capacity point on the pump curve not to exceed motor nameplate horsepower rating, excluding any service factor.

**2.04 SERVICE FACTOR**

- A. 1.15 minimum at rated ambient temperature, unless otherwise indicated.

**2.05 VOLTAGE AND FREQUENCY RATING**

- A. System Frequency: 60-Hz.
- B. Voltage Rating: Unless otherwise indicated in motor-driven equipment specifications:

Size	Voltage	Phases
1/2 hp and smaller	115	1
3/4 hp through 400 hp	460	3
450 hp and larger	4,000	3

- C. Suitable for full voltage starting.
- D. One hundred horsepower and larger also suitable for reduced voltage starting with 65 or 80 percent voltage tap settings on reduced inrush motor starters.
- E. Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 90 percent of motor rated voltage.

**2.06 EFFICIENCY AND POWER FACTOR**

- A. For all motors except single-phase, under 1 horsepower, multispeed, short-time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:
  - 1. Efficiency:
    - a. Tested in accordance with NEMA MG 1, paragraph 12.54.1.
    - b. Guaranteed minimum at full load in accordance with Table 1 or as indicated in motor-driven equipment specifications.
  - 2. Power Factor: Guaranteed minimum at full load in accordance with Table 1 or as indicated in motor-driven equipment specifications.

**2.07 LOCKED ROTOR RATINGS**

- A. Locked rotor kVA Code F or lower if motor horsepower not covered by NEMA MG 1 tables.
- B. Safe stall time 15 seconds or greater.

**2.08 INSULATION SYSTEMS**

- A. Single-Phase, Fractional Horsepower Motors: Manufacturer's standard winding insulation system.
- B. Motors Rated Over 600 Volts: Sealed windings in accordance with NEMA MG 1.

- C. Three-Phase and Integral Horsepower Motors, Unless Otherwise Indicated in Motor-Driven Equipment Specifications: Class F with Class B rise at nameplate horsepower and designated operating conditions, except EXP and DIP motors which must be Class B with Class B rise.

**2.09 ENCLOSURES**

- A. All enclosures to conform to NEMA MG 1.
- B. Unless otherwise noted, all motors shall be TEFC and shall furnish with a drain hole with porous drain/weather plug.
- C. Explosion-Proof (EXP):
  - 1. TEFC listed to meet UL 674 and NFPA 70 requirements for Class 1, Division 1, Group C and D hazardous locations.
  - 2. Drain holes with drain and breather fittings.
  - 3. Integral thermostat opening on excessive motor temperature in accordance with UL 547 and NFPA 70.
  - 4. Thermostat leads to terminate in a terminal box separate from main terminal box.
- D. Dust-Ignition-Proof (DIP):
  - 1. TEFC listed to meet UL 674 and NFPA 70 requirements for Class II, Division 1, Group E, F, G.
  - 2. Integral thermostat opening on excessive motor temperature in accordance with UL 547 and NFPA 70.
  - 3. Thermostat leads to terminate in a terminal box separate from main terminal box.
- E. Submersible: In accordance with Paragraph SPECIAL MOTORS.
- F. Chemical Industry, Severe-Duty (CISD-TEFC): In accordance with Paragraph Special Motors.

**2.10 TERMINAL (CONDUIT) BOXES**

- A. Oversize main terminal boxes for all motors.
- B. Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.
- C. Except ODP, furnish gaskets between box halves and between box and motor frame.
- D. Minimum usable volume in percentage of that specified in NEMA MG 1-11.06 and 20.62 and NFPA 70, Article 430:

<b>Voltage</b>	<b>Horsepower</b>	<b>Percentage</b>
Below 600	15 thru 125	500
Below 600	150 thru 300	275
Below 600	350 thru 600	225
Above 600	All Sizes	200

- E. Terminal for connection of equipment grounding wire in each terminal box.

## **2.11 BEARINGS AND LUBRICATION**

- A. Horizontal Motors:
  - 1. 3/4 horsepower and Smaller: Permanently lubricated and sealed ball bearings, or regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
  - 2. 1 Through 400 horsepower: Regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
  - 3. Above 400 horsepower: Regreasable antifriction bearings in labyrinth sealed end bells with removable grease relief plugs.
  - 4. Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in AFBMA 9 and 11.
- B. Vertical Motors:
  - 1. Thrust Bearings:
    - a. Antifriction bearing.
    - b. Manufacturer's standard lubrication 100 horsepower and larger.
    - c. Oil lubricated 125 horsepower and larger.
    - d. Minimum 50,000 hours L-10 bearing life.
  - 2. Guide Bearings:
    - a. Manufacturer's standard bearing type.
    - b. Manufacturer's standard lubrication 200 horsepower and larger.
    - c. Oil lubricated 250 horsepower and larger.
    - d. Minimum 100,000 hours L-10 bearing life.
- C. Regreasable Antifriction Bearings:
  - 1. Readily accessible, grease injection fittings.
  - 2. Readily accessible, removable grease relief plugs.
- D. Oil Lubrication Systems:
  - 1. Oil reservoirs with sight level gauge.
  - 2. Oil fill and drain openings with opening plugs.
  - 3. Provisions for necessary oil circulation and cooling.

## **2.12 NOISE**

- A. Measured in accordance with IEEE 85 and NEMA MG 1.
- B. Motors controlled by adjustable frequency drive systems shall not exceed sound levels of 3 dBA higher than NEMA MG 1.

## **2.13 BALANCE AND VIBRATION CONTROL**

- A. In accordance with NEMA MG 1-12.06.

## **2.14 EQUIPMENT FINISH**

- A. External Finish: Prime and finish coat manufacturer's standard. Field painting in accordance with Contract Documents.

- B. Internal Finish: Bore and end turns coated with clear polyester or epoxy varnish.

## 2.15 SPECIAL FEATURES AND ACCESSORIES

- A. Screen Over Air Openings: Stainless steel on motors with ODP, WPI, and WPII enclosures meeting requirements for Guarded Machine in NEMA MG 1.
- B. Winding Thermal Protection:
  - 1. Thermostats:
    - a. Motors for constant speed and adjustable speed application 30 through 75 horsepower.
    - b. Bi-metal disk or rod type thermostats embedded in stator windings (normally closed contact).
    - c. Automatic reset contacts rated 120 volts ac, 5 amps minimum, opening on excessive temperature. (Manual reset will be provided at motor controller.)
  - 2. Thermistors:
    - a. Motors for constant speed and adjustable speed application 100 horsepower and larger.
    - b. Thermistor embedded in each stator phase winding before winding dip and bake process.
    - c. In intimate contact with winding conductors.
    - d. Epoxy-potted, solid state thermistor control module mounted in NEMA 250, Type 4X box on motor by motor manufacturer.
    - e. Individual thermistor circuits factory-wired to control module.
    - f. Control module rated for 120 volts ac power supply.
    - g. Control module automatically reset contact for external use rated 120 volts ac, 5 amps minimum, opening on abnormally high winding temperature. Manual reset will be provided at motor controller.
  - 3. Motor Space Heaters: All motors 30 horsepower and larger except if otherwise noted, shall be furnished with 120V ac space heaters. The rating of the space heaters shall be determined in accordance with the motor manufacturer's standard for particular frame size and type. Coordinate the power requirements of the space heater with the manufacturer of motor starters or adjustable frequency drive for sizing of the control transformer. Space heater wire leads shall be brought out in the conduit box on the motor and clearly identified.
- C. Nameplates:
  - 1. Raised or stamped letters on stainless steel or aluminum.
  - 2. Display all motor data required by NEMA MG 1-10.37 and NEMA MG 1-10.38 in addition to bearing numbers for both bearings.
  - 3. Premium efficiency motor nameplates to also display NEMA nominal efficiency, full load power factor, and maximum allowable kVAR for power factor correction capacitors.

## 2.16 SPECIAL MOTORS

- A. Requirements in this article take precedence over conflicting features specified elsewhere in this section.
- B. Chemical Industry, Severe-Duty (CISD-TEFC):
  - 1. In accordance with IEEE 841.
  - 2. TEFC in accordance with NEMA MG 1.

3. Suitable for indoor or outdoor installation in severe-duty applications including high humidity, chemical (corrosive), dirty, or salty atmospheres.
  4. Motor Frame, End Shields, Terminal Box(es), and Fan Cover: Cast iron.
  5. Ventilating Fan: Corrosion-resistant, nonsparking, external.
  6. Drain and Breather Fittings: Stainless steel.
  7. Nameplate: Stainless steel.
  8. Gaskets between terminal box halves and terminal box and motor frame.
  9. Extra slinger on rotor shaft to prevent moisture seepage along shaft into motor.
  10. Double shielded bearings.
  11. 125,000 hours minimum L-10 bearing life for direct-connected loads.
  12. External Finish: Double-coated epoxy enamel.
  13. Coated rotor and stator air gap surfaces.
  14. Insulation System, Windings, and Connections:
    - a. Class F insulation, Class B rise or better at 1.0 service factor.
    - b. Multiple dips and bakes of nonhygroscopic polyester varnish.
  15. Service Factor:
    - a. At 40 Degrees C Ambient: 1.15.
    - b. At 65 Degrees C Ambient: 1.00.
  16. Safe Stall Time Without Injurious Heating: 20 seconds minimum.
- C. Severe-Duty Explosion-Proof: Meet requirements for EXP enclosures and CISD-TEFC motors.
- D. Severe-Duty, Dust-Ignition-Proof: Meet requirements for DIP enclosures and CISD-TEFC motors.
- E. Multispeed: Meet requirements for speeds, number of windings, and load torque classification indicated in the motor-driven equipment specifications.
- F. Submersible Pump Motors:
1. Manufacturers:
    - a. Reliance.
    - b. Flygt.
  2. At 100 Percent Load:

<b>Horsepower</b>	<b>Guaranteed Minimum Efficiency</b>	<b>Guaranteed Minimum Power Factor</b>
5 thru 10	80	82
10.1 thru 50	85	82
50.1 thru 100	87	82
Over 100	89	82

3. Insulation System: Manufacturer's standard Class B or Class F.
4. Motor capable of running dry continuously.
5. Enclosure:
  - a. Hermetically sealed, watertight, for continuous submergence up to 65-foot depth.
  - b. Listed to meet UL 674 and NFPA 70 requirements for Class 1, Division 1, Group D hazardous atmosphere.

- c. Seals: Tandem mechanical.
  - 6. Bearing and Lubrication:
    - a. Permanently sealed and lubricated, replaceable antifriction guide and thrust bearings.
    - b. Minimum 15,000 hours L-10 bearing life.
  - 7. Inrush kVA/horsepower no greater than NEMA MG 1 and NFPA 70, Code F.
  - 8. Winding Thermal Protection:
    - a. Thermal sensor and switch assembly, one each phase, embedded in stator windings and wired in series.
    - b. Switches normally closed, open upon excessive winding temperature, and automatically reclose when temperature has cooled to safe operating level.
    - c. Switch contacts rated at 5 amps, 120 volts ac.
  - 9. Motor Seal Failure Moisture Detection:
    - a. Probes or sensors to detect moisture beyond seals.
    - b. Probe or sensor monitoring module for mounting in motor controller, suitable for operation from 120-volt ac supply.
    - c. Monitoring module with control power transformer, probe test switch and test light, and two independent 120-volt ac contacts, one opening and one closing when the flux of moisture is detected.
  - 10. Bearing Overtemperature Protection for Motors Larger than 100 Horsepower:
    - a. Sensor on lower bearing housing monitoring bearing temperature.
    - b. Any monitoring relay necessary to provide 120-volt ac contact opening on bearing overtemperature.
  - 11. Winding thermal protection, moisture detection, and bearing overtemperature specified above may be monitored by a single device providing two independent 120-volt ac contacts, one closing and one opening on malfunction.
  - 12. Connecting Cables:
    - a. One cable containing power, control, and grounding conductors.
    - b. Each cable suitable for hard service, submersible duty with watertight seal where cable enters motor.
    - c. Length: 30 feet minimum, coordinate proper length.
    - d. UL 1 listed and sized in accordance with NFPA 70.
- G. Inclined Motors:
- 1. Motors suitable for operation only in horizontal position not acceptable.
  - 2. Bearings designed for thrust imposed by driven equipment and by motor rotor when motor is in inclined position.
  - 3. Lubrication system designed to provide adequate bearing lubrication when motor is in inclined position.
- H. Motors for Adjustable Frequency Drives (AFDs): These motors shall be specially designed inverter duty motors and comply with NEMA MG 1.31. Motor insulation shall withstand high voltages caused by fast rise time voltage pulses associated with PWM type inverters. Motor design shall take into account motor heating caused by harmonics in the drive output. Each motor for AFD application shall have a label certifying that the motor is suitable for inverter duty. Coordinate the motor full load current data with the drive manufacturer.



## **2.17 FACTORY TESTING**

- A. Tests:
  - 1. In accordance with IEEE 112 for polyphase motors and IEEE 114 for single-phase motors.
  - 2. Routine (production) tests on all motors in accordance with NEMA MG 1, plus no load power at rated voltage and polyphase, rated voltage measurement of locked rotor current. Test multispeed motors at all speeds.
  - 3. For energy efficient motors, test efficiency at 50, 75, and 100 percent of rated horsepower:
    - a. In accordance with IEEE 112, Test Method B, and NEMA MG 1, paragraphs 12.54 and 12.57.
    - b. For motors 500 horsepower and larger where facilities are not available to test by dynamometer (Test Method B), determine efficiency by IEEE 112, Test Method F.
  - 4. Power factor:
    - a. Speed.
    - b. Current at rated horsepower.
    - c. kW input at rated horsepower.
    - d. On motors of 100 horsepower and smaller, furnish a certified copy of a motor efficiency test report on an identical motor.
- B. Test Report Forms:
  - 1. Routine Tests: IEEE 112, Form A-1.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. In accordance with manufacturer's instructions and recommendations.
- B. Align motor carefully and properly with driven equipment.
- C. Secure equipment to mounting surface with anchor bolts. Provide anchor bolts meeting manufacturer's recommendations and of sufficient size and number for the specified seismic conditions.

### **3.02 FIELD QUALITY CONTROL**

- A. Refer to Section 26 08 00, Electrical Testing.

### **3.03 MANUFACTURER'S SERVICES**

- A. Furnish manufacturer's representative at site for installation assistance, inspection, equipment testing, and startup assistance for motors larger than 75 horsepower.
- B. Manufacturer's Certificate of Proper Installation.

### **3.04 SUPPLEMENTS**

- A. Table supplement, following "END OF SECTION," is a part of this Specification.
  - 1. Table 1, Motor Performance Requirements.

END OF SECTION

<b>TABLE 1</b>									
<b>MOTOR PERFORMANCE REQUIREMENTS</b>									
		<b>% Guar. Min. Full Load Efficiency</b>				<b>% Guar. Min. Full Load Power Factor</b>			
		<b>Horizontal</b>		<b>Vertical</b>		<b>Horizontal</b>		<b>Vertical</b>	
<b>hp</b>	<b>Nom. Speed rpm</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>
1	1800	80.0	81.5			Mfr.'s Std.	Mfr.'s Std.		
	1200	78.5	79.3			Mfr.'s Std.	Mfr.'s Std.		
1.5	3600	79.3	81.5			Mfr.'s Std.	Mfr.'s Std.		
	1800	79.3	82.0			Mfr.'s Std.	Mfr.'s Std.		
	1200	82.5	84.0		82.0	Mfr.'s Std.	Mfr.'s Std.		Mfr.'s Std.
2	3600	82.0	84.0			Mfr.'s Std.	Mfr.'s Std.		
	1800	81.5	83.7			Mfr.'s Std.	Mfr.'s Std.		
	1200	85.5	85.5	83.7	83.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	82.9	82.5	82.9	81.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
3	3600	82.0	84.0	82.0	82.0	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	84.8	86.5	84.8	84.8	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	87.5	88.1	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	84.1	82.9	84.1	82.9	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
5	3600	84.8	86.5	84.8	84.8	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	86.5	86.5	84.8	84.8	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	87.5	88.1	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	87.5	86.5	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
7.5	3600	86.5	88.1	84.8	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	89.3	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	88.5	88.5	88.4	87.5	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	87.5	86.5	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.

TABLE 1									
MOTOR PERFORMANCE REQUIREMENTS									
		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom. Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
10	3600	89.3	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	89.3	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	89.5	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	89.3	88.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
15	3600	88.5	89.8	88.4	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	91.0	91.0	90.9	90.2	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	90.2	90.2	90.2	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	89.3	88.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
20	3600	91.0	90.6	90.9	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	91.7	91.7	91.7	90.9	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	91.0	90.6	90.2	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	90.2	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
25	3600	91.7	91.0	91.7	90.2	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	92.4	92.4	92.4	91.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	91.7	91.0	90.9	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	90.2	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
30	3600	91.7	91.4	89.5	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1800	92.4	92.4	92.4	91.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1200	91.7	91.0	91.7	90.2	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	91.7	91.7	90.9	90.9	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
40	3600	91.7	91.7	90.2	89.3	86.6	86.1	87.0	89.0
	1800	93.6	93.0	92.8	91.7	78.2	78.2	83.0	84.5
	1200	92.4	92.4	91.7	90.9	81.5	81.5	81.5	81.5
	900	91.7	91.0	90.9	90.2	70.0	70.5	70.0	70.5
50	3600	92.0	92.0	90.2	89.3	85.1	86.7	89.0	89.0

<b>TABLE 1</b>									
<b>MOTOR PERFORMANCE REQUIREMENTS</b>									
		<b>% Guar. Min. Full Load Efficiency</b>				<b>% Guar. Min. Full Load Power Factor</b>			
		<b>Horizontal</b>		<b>Vertical</b>		<b>Horizontal</b>		<b>Vertical</b>	
<b>hp</b>	<b>Nom.Speed rpm</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>
	1800	93.6	93.0	92.8	91.7	79.5	79.4	82.5	82.5
	1200	92.4	92.4	91.7	90.9	81.5	81.5	81.5	81.5
	900	91.7	91.7	90.9	90.9	78.5	72.9	78.5	80.0
60	3600	92.7	93.0	91.7	90.9	85.8	88.3	87.5	89.0
	1800	93.6	94.1	93.5	92.8	80.5	79.9	80.5	80.5
	1200	93.0	93.0	92.8	91.7	81.5	81.5	81.5	81.5
	900	92.4	91.7	91.7	90.9	79.5	73.2	79.5	79.5
70	3600	93.6	93.6	91.7	91.7	87.1	88.5	88.5	88.5
	1800	94.5	94.5	93.5	93.5	81.0	81.5	81.0	81.5
	1200	93.6	93.5	93.5	92.8	82.0	82.0	82.0	82.0
	900	92.8	92.4	92.8	91.7	80.5	74.5	80.5	81.0
100	3600	93.6	93.3	91.7	90.7	87.0	88.2	87.0	88.5
	1800	95.1	94.5	94.0	93.5	81.0	81.0	81.0	81.0
	1200	93.6	93.6	92.8	92.8	82.1	81.7	85.5	85.5
	900	93.5	92.4	92.8	91.7	77.0	77.3	77.0	80.0
125	3600	93.6	93.7	91.7	91.7	86.4	89.1	87.0	90.5
	1800	94.5	94.7	93.5	92.8	85.4	85.5	87.5	86.0
	1200	93.6	94.1	93.5	92.8	82.7	82.3	85.5	85.5
	900	93.5	93.0	92.8	92.4	78.5	78.5	78.5	78.5
150	3600	93.6	93.7	92.4	91.7	86.5	90.0	86.5	90.5
	1800	95.0	95.2	94.5	94.0	82.5	85.0	84.5	85.0
	1200	94.5	94.5	93.5	94.0	81.5	81.5	81.5	81.5
	900	93.5	93.0	92.8	92.4	78.0	78.5	78.0	78.5
200	3600	94.3	94.3	92.4	93.0	87.8	89.4	91.0	91.0
	1800	95.0	95.2	94.0	94.0	85.2	86.5	87.0	87.0

<b>TABLE 1</b>									
<b>MOTOR PERFORMANCE REQUIREMENTS</b>									
		<b>% Guar. Min. Full Load Efficiency</b>				<b>% Guar. Min. Full Load Power Factor</b>			
		<b>Horizontal</b>		<b>Vertical</b>		<b>Horizontal</b>		<b>Vertical</b>	
<b>hp</b>	<b>Nom. Speed rpm</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>	<b>Drip-proof ODP</b>	<b>TEFC</b>
	1200	94.5	94.5	93.5	93.5	79.0	82.5	79.0	82.5
250	3600	94.3	94.7	91.7	92.4	85.0	86.5	85.0	96.5
	1800	85.4	95.4	94.5	94.5	79.0	79.0	79.0	79.0
	1200	95.0	94.5	94.5	93.5	82.0	82.0	82.0	82.0
300	3600	93.7	94.3			89.8	89.9		
	1800	95.4	95.2	94.5	94.0	80.0	80.0	80.0	80.0
	1200	93.7	93.7			84.5	90.1		
350	3600	94.3	94.7			89.4	85.9		
	1800	94.7	94.7			85.9	85.9		
400	3600	94.3				88.4			
	1800	94.37				86.8			
450	3600	94.7				89.1			
500	3600	94.7				88.3			

END OF SECTION

## **SECTION 26\_29\_23**

### **VARIABLE FREQUENCY DRIVES**

#### **PART 1 GENERAL**

##### **1.01 SCOPE OF WORK**

- A. Provide all labor, materials, equipment and incidentals required, and install, place in operation and field test variable frequency drive(s) (VFD's).
- B. The variable frequency drive shall be a space vector Pulse-Width Modulated (PWM) design. Modulation methods which incorporate "gear-changing" techniques are not acceptable. The final responsibility of distributor or packager modifications to a third-party standard product will reside with the VFD manufacturer. The VFD manufacturer shall have overall responsibility for the drives. All drives shall be supplied by one manufacturer. The VFD shall be manufactured within the United States of America to alleviate concerns of future serviceability and parts availability.
- C. VFD below 200HP shall be six (6) pulse units with 5% input line reactor and output reactor/output filter. VFD 200HP and above shall be eighteen (18) pulse with output reactor/output filter.

##### **1.02 RELATED WORK SPECIFIED ELSEWHERE**

- A. Pumps, General.
- B. Section 26 20 00 - Electric Motors.
- C. Division 40 – Instrumentation.

##### **1.03 QUALITY ASSURANCE**

- A. The entire VFD system as described in section 2.01B shall be factory assembled and system tested by the VFD manufacturer to assure a properly coordinated system.
- B. Codes: Provide equipment in full accordance with the latest applicable rules, regulations, and standards of:
  - 1. Local Laws and Ordinances.
  - 2. State and Federal Laws.
  - 3. National Electric Code (NEC).
  - 4. Underwriters Laboratories (UL).
  - 5. American National Standards Institute (ANSI).
  - 6. National Electrical Manufacturers Association (NEMA).
  - 7. Institute of Electrical and Electronics Engineers (IEEE).
- C. The complete drive system shall be UL listed.
- D. Acceptable Manufacturers:

1. Square D.
2. Allen-Bradley.
3. Eaton Electrical.
4. No Approved "or Equal"

#### **1.04 SUBMITTALS**

- A. Submittals shall conform in all respects to Section 01\_33\_00.
- B. Submittals shall be custom prepared by the VFD manufacturer for this specific application.
- C. Submittal information shall include, but not be limited to:
  1. Equipment dimensions, including stub-up locations, shipping splits and shipping weights.
  2. Catalog cuts of major components.
  3. Spare parts list, per Paragraph 3.03.
  4. Certifications, including:
    - a. Warranty, per section 1.04.
    - b. Efficiencies, per section 2.02.A.1.
  5. Harmonic Distortion Analysis, per section 2.01D.

#### **1.05 WARRANTY**

- A. All equipment furnished under this section shall be warranted for on site parts and labor by the contractor and the equipment manufacturers for a period of five (5) years after completion of startup.

### **PART 2 PRODUCTS**

#### **2.01 MATERIAL AND EQUIPMENT**

- A. Any modifications to a standard product required to meet this specification shall be performed by the VFD manufacturer only. Distributor or system integrator changes to the VFD manufacturer's product are specifically disallowed.
- B. The VFD system shall consist of a power factor correction / harmonic filter unit, input rectifier-grade phase-shifting transformer, 6 pulse converter section, output inverter and control logic section, harmonic filtering unit, input line reactor, and output filter. All components listed including power factor correction / harmonic filter shall be integral to the VFD lineup, factory wired and tested as a complete system. The entire VFD system shall meet the requirements of NEC article 409 and IEEE 508A for fault current withstand ratings as indicated on the project electrical drawings.
- C. Input circuit breaker, interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power and shall be capable of being locked in the open position.
- D. VFD system shall maintain a 0.95 minimum true power factor throughout the entire speed range.

## 2.02 VARIABLE FREQUENCY DRIVES

### A. Ratings

1. The drive system shall be 96% efficient at full load and full speed and 95.5% efficient at 51% load and 80% speed. Losses to be utilized in drive system efficiency calculation shall include input transformer, harmonic filter and power factor correction if applicable, VFD converter and output filter if applicable. Auxiliary controls, such as internal VFD control boards, cooling fans or pumps, shall be included in all loss calculations.
2. Rated Input Power: 460 Volts 60 Hz, +10%, -5% at rated load, 3-phase.
  - a. Voltage Dip Ride-Through: VFD shall be capable of sustaining continued operation with a 40% dip in nominal line voltage. Output speed may decline only if current limit rating of VFD is exceeded.
  - b. Power Loss Ride-through: VFD shall be capable of a minimum 3 cycle power loss ride-through without fault activation.
3. Output Power: As required by motors supplied.
4. Ambient Temperature Range: 0 to 40°C.
5. Elevation: Up to 3300 feet (1000 meters) above MSL without derating.
6. Atmosphere: Non-condensing relative humidity to 95%.
7. AC Line Frequency Variation: +/- 3 Hertz.
8. Power Unit Rating Basis: 110% rated current continuous, 150% rated current for one minute, at rated temperature.

### B. Construction

1. The controller shall produce an adjustable AC voltage/frequency output. It shall have an output voltage regulator to maintain correct output V/Hz ratio despite incoming voltage variations.
2. The controller shall have a continuous output current rating of 100% of motor nameplate current.
3. The converter section shall be 6 pulse minimum utilizing diodes.
4. The inverter output shall be generated by IGBTs. Pulse Width Modulation strategy will be of the space vector type implemented to generate a sine-coded output voltage. The VFD shall not induce excessive power losses in the motor. The worst case RMS motor line current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation. The inverters shall be able to sustain 1600 volt surges.
5. The controller(s) shall be suitable for use with any standard NEMA-B squirrel-cage induction motor(s) having a 1.15 Service Factor or with existing standard NEMA-B squirrel-cage induction motor(s) with nameplate data as shown on the plans. Provide drives with dV/dT output filters manufactured by Trans-Coil type KLC. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage and RPM) in the field.
6. The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resistors. A power failure will not necessitate a reload of any drive parameter or configuration.
7. Minimum Starting Speed: When called to operate, the VFD shall immediately ramp to a minimum speed. The minimum speed shall be adjustable but initially set at 60% of maximum speed. The 4-20 MA speed signal from the PLC and potentiometer on the front of the drive shall modulate the signal between the minimum speed setpoint and the maximum output speed of the drive; i.e., at the 4 MA signal, the VFD shall run at the minimum speed. At the 20 MA signal, the VFD shall run at full speed. The potentiometer shall also adjust speed



between the minimum speed setpoint and the maximum running speed. Below the minimum speed setpoint, the potentiometer shall have no effect.

8. All 6-pulse VFD's shall be provided with 5% input line reactors.

C. Basic Features

1. The door of each power unit shall include: a keypad with a manual speed device, "HAND / OFF / REMOTE" mode selector switch, "POWER ON" light, "VFD FAIL" light, VFD "RUNNING" light, fault reset pushbutton, "MOTOR OVER TEMPERATURE" light, "MOTOR HEATER ON" light, "ENCLOSURE OVER TEMPERATURE" light, "DRIVE LOCKOUT" light, CONTROL POWER ON light, START and STOP pushbuttons and a TEST / NORMAL selector switch. All lights shall be LED type.
2. The VFD shall include a customer selectable automatic restart feature. When enabled, the VFD shall automatically attempt to restart after a trip condition resulting from instantaneous overcurrent, overvoltage, out of saturation or overload. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function (programmable for up to 3 attempts) is not successful within a customer programmable time period. Auto-Restart shall be programmable to allow for individual fault selection.
3. A door-mounted membrane keypad with integral 2-line minimum, 24-character LCD display shall be furnished, capable of controlling the VFD and setting drive parameters. The keypad shall include the following features:
  - a. The digital display must present all diagnostic message and parameter values in English engineering units when accessed, without the use of codes.
  - b. The digital keypad shall allow the operator to enter exact numerical settings in English engineering units. A user menu written in plain English (rather than codes) shall be provided in software in nonvolatile memory as a guide to parameter setting and resettable in the field through the keypad. Multiple levels of password security shall be available to protect drive parameters from unauthorized personnel. The drive set up parameters must be able to be transferred to new boards to reprogram spare boards.
  - c. The following digital door-mounted keypad indications may be selectively displayed:
    - 1) Speed demand in percent.
    - 2) Output current in amperes.
    - 3) Output Frequency in hertz.
    - 4) Input voltage.
    - 5) Output voltage.
    - 6) Total 3-phase KW.
    - 7) Kilowatt hour meter
    - 8) Elapsed time running meter.
    - 9) RPM.
    - 10) DC bus voltage.
  - d. VFD shall have the capability of communicating via an RS-232, RS-422, or RS-485 port.
  - e. VFD parameters, fault log and diagnostic log shall be downloadable via the RS-232, RS-422, or RS-485 port.
4. Refer to the VFD wiring diagram in the drawings for remote signals and alarms.

D. Enclosure

1. All VFD components shall be factory mounted and wired on a dead front, grounded, NEMA-1 enclosure. If a free-standing enclosure is provided, it shall be suitable for mounting on a concrete housekeeping pad. Maximum enclosure dimensions for various VFD sizes shall be as follows:
  - a. 50 HP (6-pulse): 32 W x 24"D x 92"H
  - b. 250 HP (18-pulse): 48"W x 32"D x 92" H

E. Protective Features and Circuits: The controller shall include the following alarms and protective features:

1. Instantaneous overcurrent and overvoltage trip.
2. Undervoltage and power loss protection.
3. Power unit overtemperature alarm and protection. Upon sensing an overtemperature condition, the VFD is to automatically trip.
4. Electronic motor inverse time overload protection.
5. Responsive action to motor winding temperature detectors or thermostatic switches. A dry contact (NC) input to the VFD is required.
6. When power is restored after a complete power outage, the VFD shall be capable of catching the motor while it is still spinning and restoring it to proper operating speed without the use of an encoder.
7. The VFD shall be protected from damage due to the following, without requiring an output contactor:
  - a. Three-phase short circuit on VFD output terminals.
  - b. Loss of input power due to opening of VFD input disconnecting device or utility power failure during VFD operation.
  - c. Loss of one (1) phase of input power.
8. The VFD shall continue to operate at a reduced capacity under a single-phase fault condition.
9. The VFD shall be able to withstand the following fault conditions without damage to the power circuit components:
  - a. Failure to connect a motor to the VFD output.
  - b. VFD output open circuit that may occur during operation.
  - c. VFD output short circuit that may occur during operation.
10. Provide input line reactors (5% impedance) when no 12 or 18 pulse transformers are supplied or required.
11. Three phase lightning and surge protection across the line input at each VFD. Lea Dynatec TVSS #GB-100.
12. Provide 120V motor heater power that is active when the motor is off and is off when the motor is active.

F. Parameter Settings

1. The following system configuring settings shall be provided and field adjustable, without exception, through the keypad/display unit. Except for Motor Nameplate Data, all parameters must be adjustable while the processor is on-line and the drive is running.
  - a. Motor Nameplate Data.
    - 1) Motor frequency.
    - 2) Number of poles.
    - 3) Full load speed.
    - 4) Motor volts.
    - 5) Motor full load amps.
    - 6) Motor HP.

- 7) Current limit, max.
- b. VFD Configuration Parameters.
  - 1) Independent accelerate/decelerate rates.
  - 2) Max/Min speed (frequency).
  - 3) Catch-a spinning load selection.
  - 4) No load boost.
  - 5) Full load boost.
  - 6) Volts/Hertz ratio.
  - 7) Overspeed trip.
  - 8) Overload trip curve selection.
  - 9) Overload trip time selection.
- c. Automatic VFD Control.
  - 1) PID utilizing an internal or external setpoint.
  - 2) Three selectable critical speed avoidance bands with programmable bandwidths.
  - 3) Auto start functions: On/Off, Delay On/Off. Operable from a 4-20mA signal or from the PID output, command, or feedback signal.
  - 4) Speed Profile: Programmable entry and exit points.
  - 5) Programmable loss of signal control: Stop, maintain last speed, or default to preselected setpoint.
- 2. All drive setting adjustments and operation parameters shall be stored in a parameter log which lists allowable maximum and minimum points as well as the present set values. This parameter log shall be accessible via a RS-232, RS-422, or RS-485 serial port as well as on the keypad display.

#### G. Input/Output Features

- 1. Two programmable analog inputs: VFD speed in, spare.
- 2. Three programmable analog outputs: VFD speed output, Drive (output) current in Amps, spare.
- 3. Two programmable digital inputs: Run, spare.
- 4. Ten programmable digital outputs: VFD fault, VFD running, VFD in remote, 6 spare.
- 5. One Pot input (three wire control, +10 V, wiper and common).
- 6. System Program providing built-in drive control or application specific configuration capability.

#### H. Diagnostic Features and Fault Handling

- 1. The VFD shall include a comprehensive microprocessor based digital diagnostic system that monitors its own control functions and displays faults and operating conditions.
- 2. A "Fault Log" shall be accessible via a RS-232, RS-422, or RS-485 serial link as well as line-by-line on the keypad display. The "FAULT LOG" shall record, store, display and output to a serial port upon demand, the following for the 64 most recent events:
  - a. Date and time of day.
  - b. Type of fault.
  - c. All faults and events shall be stored and displayed in English, not fault codes.
- 3. A "HISTORIC LOG" shall record, store, and output to a RS-232, RS-422, or RS-485 serial link port upon demand, the following selectable control variables at 1 msec. intervals for the 58 intervals immediately preceding and the 20 intervals immediately following a fault trip:

- a. Torque demand.
- b. Torque command.
- c. Torque feedback.
- d. Torque error.
- e. Torque maximum.
- f. Current demand.
- g. Peak current.
- h. Motor current.
- i. DC bus voltage.
- j. Line voltage.
- k. Velocity demand.
- l. Velocity reference.
- m. PI min/max limit.
- n. Boost.
- o. VFD mode (Auto/Manual).

## **PART 3 EXECUTION**

### **3.01 FACTORY TESTING**

- A. The VFD manufacturer shall provide as a minimum, the following quality assurance steps within his factory:
  - 1. Incoming inspection of components and raw materials based on strategic supplier base and experience. Sampling plans based on MIL STD 105E.
  - 2. MIL STD 45662 calibration system.
  - 3. All products subject to 100% testing and final inspection; no sampling plans permitted.

### **3.02 PRE-DELIVERY TESTING COORDINATION**

- A. One VFD unit of each specified type and application shall be shipped to the pump manufacturer's test facility for complete operational testing. The VFD Manufacturer shall provide a qualified representative at the pump Manufacturer's test facility during testing. All costs incurred by the VFD Manufacturer to meet this requirement shall be included in the bid.
- B. Certified test reports shall be submitted to the ENGINEER before the equipment is shipped to the project site.

### **3.03 SPARE PARTS**

- A. The following spare parts shall be furnished:
  - 1. Three of each type of fuse rated 460V or less.
  - 2. Two of each type of converter power semiconductor.
  - 3. Two of each type of inverter power semiconductor.
  - 4. One of each type of type control printed circuit board and gate firing boards.
  - 5. One keypad assembly.

### **3.04 FIELD QUALITY CONTROL**

- A. Functional Test:
  - 1. Conduct on each VFD.

2. Inspect controller for electrical supply termination connections, interconnections, proper installation, and quiet operation.
  3. Vibration Test: Complete assembly, consisting of motor, load, and flexible shafting, connected and in normal operation, shall not develop amplitudes of vibration exceeding limits recommended by current edition of Hydraulic Institute Standards. Where pumps and motors are separated by intermediate flexible shafting, measure vibration both at top motor bearing and at two points on top pump bearing, 90 degrees apart.
  4. Record test data for report.
- B. Performance Test:
1. Conduct on each VFD.
  2. Perform under actual or approved simulated operating conditions.
  3. Test for continuous 48-hour period without malfunction.
  4. Demonstrate performance by operating the continuous period while varying the application load, as the input conditions allow, in order to verify system performance.
  5. Record test data for report

END OF SECTION

## SECTION 40\_05\_00.01

### COMMON WORK RESULTS FOR GENERAL PIPING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Basic piping materials and methods.
- B. Related sections:
  - 1. Section 40\_05\_31.01 - Plastic Piping and Tubing.
  - 2. Section 40\_05\_00.09 - Piping Systems Testing.

##### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
  - 1. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through 24.
  - 2. B16.47 - Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard.
- B. American Water Work Association (AWWA):
  - 1. C207 - Standard for Steel Pipe Flanges for Waterworks Services-Size 4 Inches through 144 Inches.
- C. ASTM International (ASTM):
  - 1. A 53 – Standard Specification for Steel Pipe, Black and Hot Dipped Zinc Coated, Welded and Seamless
  - 2. A 193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - 3. A 194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - 4. A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - 5. D 2310 – Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
  - 6. D 2996 – Standard Classification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
  - 7. F 37 - Standard Test Methods for Sealability of Gasket Materials.

##### 1.03 DEFINITIONS

- A. Buried pipe: Pipe that is buried in the soil, or cast in a concrete pipe encasement that is buried in the soil.
- B. Exposed pipe: Pipe that is located above ground, or pipe that is located inside a structure, supported by a structure, or cast into a concrete structure.
- C. Underground piping: Piping actually buried in soil or cast in concrete that is buried in soil.

- D. Underwater piping: Piping below tops of walls in basins or tanks containing water.
- E. Wet wall: Wall with water on at least 1 side.

#### **1.04 SUBMITTALS**

- A. Product data:
  - 1. Flange bolts.
  - 2. Gaskets.

### **PART 2 PRODUCTS**

#### **2.01 NOT USED - ESCUTCHEONS**

#### **2.02 NOTE USED - LINK TYPE SEALS**

#### **2.03 FLANGE BOLTS**

- A. Lubricant for stainless steel bolts and nuts:
  - 1. Chloride-free.
  - 2. Manufacturers: One of the following or equal:
    - a. Huskey FG-1800
- B. Plastic pipe:
  - 1. Bolts and nuts for flanges on plastic pipe located indoors, outdoors above ground, or in dry vaults and structures shall be carbon steel, in accordance with ASTM A 307, Grade B.
  - 2. Bolts and nuts for flanges on plastic pipe submerged in water or wastewater, buried, in wet vaults or structures, adjacent to wet walls, or above open water-containing structures and plastic pipe carrying corrosive chemicals shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.
  - 3. Provide a washer for each nut. Washer shall be of the same material as the nut.
  - 4. Nuts shall be Heavy hex-head.
  - 5. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
  - 6. Tap holes for cap screws or stud bolts when used.
- C. Steel pipe:
  - 1. Bolts and nuts for ASME B16.5 Class 150 flanges and AWWA C207 Class D flanges located indoors, outdoors above ground, or in dry vaults and structures shall be carbon steel, ASTM A 307, Grade B.
  - 2. Bolts and nuts for ASME B16.5 and B16.47 Class 300 flanges and AWWA C207 Class E and F flanges located indoors, outdoors above ground, or in dry vaults and structures in accordance with ASTM A 193, Grade B7 for bolts and in accordance with ASTM A 194, Grade 7 for nuts.
  - 3. Bolts and nuts for flanges submerged in water or wastewater, buried, in wet vaults or structures, adjacent to wet walls, or above open water-containing structures shall be Type 316 stainless steel in accordance with ASTM A 193, Grade B8M for bolts and in accordance with ASTM A 194, Grade 8M for nuts.

4. Provide a washer for each nut. Washer shall be of the same material as the nut.
5. Nuts shall be Heavy hex-head, Type 2H.
6. Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face of nut after assembly.
7. Tap holes for cap screws or stud bolts when used.

## **2.04 GASKETS**

- A. Gaskets for flanged joints in polyvinyl chloride and high density polyethylene piping:
  1. Suitable for pressures equal to or less than 150 pounds per square inch gauge, with low flange bolt loadings, temperatures equal and less than 120 degrees Fahrenheit, and polymer, chlorine, caustic solutions, and other chemicals, except chemicals which liberate free fluorine including fluorochemicals and gaseous fluorine.
  2. Material: 0.125-inch thick Viton rubber.
  3. Manufacturers: One of the following or equal:
    - a. Garlock.
    - b. John Crane, similar product.
- B. Gaskets for flanged joints in ductile iron or steel water piping:
  1. Suitable for hot or cold water, pressures equal to or less than 150 pounds per square inch gauge, and temperatures equal to or less than 160 degrees Fahrenheit.
  2. Material:
    - a. Neoprene elastomer, compressed, with non-asbestos fiber reinforcement.
    - b. Teflon ring; or Teflon envelope with non-asbestos filler.
  3. Manufacturers: One of the following or equal:
    - a. Garlock, Bluegard 3300.
    - b. John Crane, similar product.
- C. Provide gaskets suitable for the specific fluids and pressure and temperature conditions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verification of existing conditions:
  1. Locate and expose existing structures, piping, conduits, and other facilities and obstructions that may affect construction of underground piping before starting excavation for new underground piping and appurtenances.
  2. Verify sizes, elevations, locations, and other relevant features of existing facilities and obstructions. Determine conflicts for the construction of the new underground piping and appurtenances.
  3. Make piping location and grade adjustments to resolve conflicts between new piping and existing facilities and obstructions.

### **3.02 INSTALLATION**

- A. General:
  1. Piping drawings:



- a. Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.
  - b. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed.
    - 1) Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Times.
2. Piping alternatives:
    - a. Provide piping as specified in this Section, unless indicated on the Drawings or specified otherwise.
    - b. Alternative pipe ratings: Piping with greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price. Piping of different material may not be substituted in lieu of specified piping.
    - c. Valves in piping sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.
    - d. For flanged joints, where 1 of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.
  3. Unless otherwise indicated on the Drawings, piping at pipe joints, fittings, couplings, and equipment shall be installed without rotation, angular deflection, vertical offset, or horizontal offset.
- B. Wall and slab penetrations:
1. Provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, unless specified or otherwise indicated on the Drawings.
  2. For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping.
    - a. Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.
    - b. Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.
    - c. Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or ceilings of finished spaces within buildings.
    - d. Seal spaces between pipes and sleeves with link-type seals when not otherwise specified or indicated on the Drawings.
  3. Provide flexibility in piping connecting to structures to accommodate movement due to soil settlement and earthquakes. Provide flexibility using details indicated on the Drawings.
- C. Exposed piping:
1. Install exposed piping in straight runs parallel to the axes of structures, unless otherwise indicated on the Drawings.
  2. Install exposed piping after installing equipment and after piping and fitting locations have been determined.

3. Support piping: As specified in Contract Documents:
    - a. Do not transfer pipe loads and strain to equipment.
  4. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, flanged coupling adapters, and other types of joints or means which are compatible with and suitable for the piping system, and necessary to allow ready assembly and disassembly of the piping.
  5. Assemble piping without distortion or stresses caused by misalignment:
    - a. Match and properly orient flanges, unions, flexible couplings, and other connections.
    - b. Do not subject piping to bending or other undue stresses when fitting piping. Do not correct defective orientation or alignment by distorting flanged joints or subjecting flange bolts to bending or other undue stresses.
    - c. Flange bolts, union halves, flexible connectors, and other connection elements shall slip freely into place.
    - d. Alter piping assembly to fit, when proper fit is not obtained.
    - e. Install eccentric reducers or increasers with the top horizontal for pump suction piping.
- D. Restraining piping:
1. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:
    - a. When piping is underground, use concrete thrust block or mechanical restraints.
    - b. When piping is aboveground or underwater, use mechanical or structural restraints.
    - c. Determine thrust forces by multiplying the nominal cross sectional area of the piping by design test pressure of the piping.
  2. Provide restraints with ample size to withstand thrust forces resulting from test pressures:
    - a. During testing, provide suitable temporary restraints where piping does not require permanent restraints.
  3. Place concrete thrust blocks against undisturbed soil. Place concrete so piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.
  4. Provide underground mechanical restraints where specified in the Piping Schedule.
- E. Connections to existing piping:
1. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings:
    - a. Protect domestic water/potable water supplies from contamination:
      - 1) Make connections between domestic water supply and other water systems in accordance with requirements of public health authorities.
      - 2) Provide devices approved by OWNER of domestic water supply system to prevent flow from other sources into the domestic supply system.
  2. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.
  3. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.

4. For flanged connections, provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.
- F. Connections to in-service piping:
1. Where operation and maintenance of existing facilities require that a shutdown be made during hours other than normal working hours, perform the related work in coordination with the hours of actual shutdown.
- G. Connections between ferrous and nonferrous metals:
1. Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.
  2. Nonferrous metals include aluminum, copper, and copper alloys.
- H. Flanged connections between dissimilar metals such as ductile iron pipe and steel pipe:
1. Provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

### **3.03 CLEANING**

- A. Piping cleaning:
1. Upon completion of installation, clean piping interior of foreign matter and debris. Perform special cleaning when required by the Contract Documents.
- B. Cleaning potable water piping:
1. Flush and disinfect potable water piping as specified in Contract Documents.

### **3.04 PIPING SCHEDULE**

- A. Refer pipe schedule in the Drawings.

END OF SECTION

## SECTION 40\_05\_00.03

### MECHANICAL AND PIPE IDENTIFICATION

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Mechanical Identification including the following:
  - 1. Equipment nameplates.
  - 2. Pipe identification by color and legend.
  - 3. Special items.
- B. Related sections:
  - 1. Section 01\_33\_00 - Submittal Procedures.
  - 2. Section 01\_60\_00 - Product Requirements.
  - 3. Section 01\_77\_00 - Closeout Procedures.

##### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
  - 1. A13.1 - Scheme for the Identification of Piping Systems.

##### 1.03 SUBMITTALS

- A. Submit as specified in Section 01\_33\_00.
- B. Submit following:
  - 1. Product data.
  - 2. Samples.
  - 3. Manufacturer's installation instructions.
  - 4. Submit following as specified in Section 01\_77\_00 and Section 01\_78\_23:
    - a. Operation and Maintenance Data.
    - b. Warranty.

#### PART 2 PRODUCTS

##### 2.01 EQUIPMENT NAMEPLATES

- A. Material and fabrication:
  - 1. Stainless steel sheet engraved or stamped with text, holes drilled, or punch for fasteners.
- B. Fasteners:
  - 1. Number 4 or larger oval head stainless steel screws or drive pins.
- C. Text:
  - 1. Manufacturer's name, equipment model number and serial number, identification tag number; and when appropriate, drive speed, motor horsepower with rated capacity, pump rated total dynamic head.

## 2.02 PIPE IDENTIFICATION

### A. Manufacturers:

1. One of the following or equal:
  - a. Seton, Opti Code Pipe Markers.
  - b. Lab Safety Supply.
  - c. Marking Services, Inc.

### B. Materials:

1. Pipe markers: Self-adhesive vinyl, suitable for outdoor application from -40 degrees to 180 degrees Fahrenheit; meet ASME A13.1 requirements.

#### a. Lettering:

Nominal Pipe Diameter	Lettering Size
Less than 1.5	1/2 inch
1.5 inches to 2 inches	3/4 inch
2.5 inches to 6 inches	1-1/4 inches
8 inches to 10 inches	2-1/2 inches
Over 10 inches	3-1/2 inches

#### b. Marker colors:

Service	Lettering	Background
Flammables, chemicals, toxics	Black	Yellow
Water, nontoxic solutions or low hazard liquids	White	Green
Nonflammable or nontoxic gases	White	Blue
Fire quenching fluids (foam, fire water, CO <sub>2</sub> Halon)	White	Red

2. Coating: As specified in Contract Documents.
3. Pipe identification tags: Aluminum or stainless steel with stamped-in 1/4 inch high identifying lettering.
4. Pipe identification tag chains: Aluminum or stainless steel.
5. Snap-on markers: Markers with 3/4 inch high letters for 3/4 to 4 inch pipe or covering, or 5 inch high letters for 5 inch or larger pipe or cover, as manufactured by one of following:
  - a. Brady Bradysnap-On B-915.
  - b. Seton Setmark.

## 2.03 SPECIAL ITEMS

### A. In addition, special coating of following items will be required:

Item	Color
Valve handwheels and levers	Red
Hoist hooks and blocks	Yellow and black stripes

- B. Paint minimum 2 inches high numbers on or adjacent to accessible valves, pumps, flowmeters, and other items of equipment which are indicated on the Drawings or in Specifications by number.

## **2.04 NOT USED - UNDERGROUND WARNING TAPE**

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify satisfactory conditions of substrate for applying identification.
- B. Verify that conditions are satisfactory for installation and application of products as specified in Section 01\_60\_00.

#### **3.02 PREPARATION**

- A. Prepare and coat surfaces as specified in Contract Documents.
- B. Prepare surface in accordance with product manufacturer's instructions.

#### **3.03 PIPING IDENTIFICATION**







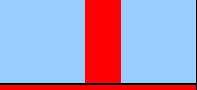




- A. Identify exposed piping, valves, and accessories, and piping in accessible chases with lettering or tags designating service of each piping system with flow directional arrows and color code.
- B. Color code:
  - 1. Coat piping scheduled to be color coded completely with specified colors as scheduled in this Section.
  - 2. Coat segments of pipe specified to be unpainted with specified coding color long enough to accommodate lettering and arrows.
  - 3. Paint all piping with colors as scheduled in this Section in the Piping Color Code and Marker Schedule. Paint colored bands on piping if required by Piping Color Code and Marker Schedule. Colored bands shall be 6 inches in width and shall be spaced at intervals not to exceed 10 ft.
- C. Lettering and flow direction arrows:
  - 1. Stencil lettering on painted labeling bands or use snap-on markers on pipe to identify pipe. When stenciling, stencil 3/4 inch high letters on 3/4 through 4-inch pipe or coverings, or 5-inch high letters on 5-inch and larger pipe or coverings.
  - 2. Provide lettering and flow direction arrows near equipment served, adjacent to valves, both sides of walls and floors where pipe passes through, at each branch or tee, and at intervals of not more than 50 feet in straight runs of pipe.
- D. Where scheduled, space 6-inch wide colored labeling bands along stainless steel pipe at 10-foot intervals and other pipe at 5-foot intervals.
- E. Label chemical tank fill pipelines at locations which are visible from chemical fill stations.
- F. Clearly label each chemical feed pipe at metering pump skid to indicate injection point location.
- G. Metal tags:

1. Where outside diameter of pipe or pipe covering is 5/8 inch or smaller, provide metal pipe identification tags instead of lettering.
2. Fasten pipe identification tags to pipe with chain.
3. Where tags are used, color code pipe as scheduled.



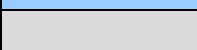
### **3.04 APPLICATION**

- A. Identify piping with legend markers, directional arrow markers, and number markers; use self-adhesive arrow roll tape to secure ends of piping markers and indicate flow direction.
- B. Provide legend markers, directional arrow markers, and number markers where piping passes through walls or floors, at piping intersections and at maximum 15 foot spacing on piping runs.
- C. Provide piping marker letters and letter background with colors as scheduled.
- D. Place markers on piping so they are visible from operator's position in walkway or working platform near piping. Locate markers along horizontal centerline of pipe, unless better visibility is achieved elsewhere.

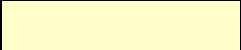


### 3.05 PIPING COLOR CODE AND MARKER SCHEDULE

Service	Color of Pipe	Color of Band	Example	Bruning Color Codes	Marker Background Color	Marker Letter Color
ANHYDROUS AMMONIA	White	None		White 532-00	Yellow	Black
BLOWER AIR	Green	None		Green 532-27	Blue	White
CARBON DIOXIDE	Light Gray	Dark Green		Cruiser Gray 532-31 Verdi Green 532-26	Blue	White
CAUSTIC SODA	Yellow	Green		Yellow 532-35 Green 532-27	Yellow	Black
CHEMICAL DRAIN AND VENT	Yellow	None		Yellow 532-35	Yellow	Black
COMPRESSED AIR	Dark Green	None		Verdi Green 532-26	Blue	White
CORROSION INHIBITOR	Light Green	Red		Ivy Laurel T112-4 Red 536-28	Yellow	Black
FLUORIDE	Light Blue	Red		Ethreal T36-5 Red 532-28	Yellow	Black
GAS or FUEL	Red	None		Red 532-28	Yellow	Black
MEMBRANE CLEANING PERMEATE	None	None	N/A	N/A	Green	White
MEMBRANE CLEANING RETURN	Light Brown	None		Rustic Cedar 532-40	Yellow	Black
MEMBRANE CLEANING SUPPLY	Light Brown	None		Rustic Cedar 532-40 Dark Orange	Yellow	Black
MEMBRANE CLEANING WASTE	Dark Brown	Orange		Acorn 532-36 Orange 532-29	Yellow	Black
MEMBRANE CONCENTRATE	None	None	N/A	N/A	Green	White
MEMBRANE FEED	None	None	N/A	N/A	Green	White



Service	Color of Pipe	Color of Band	Example	Bruning Color Codes	Marker Background Color	Marker Letter Color
MEMBRANE PERMEATE (inside)	None	None	N/A	N/A	Green	White
MEMBRANE PERMEATE (outside)	Aqua	None		Catalina 57-9D	Green	White
POTABLE WATER	Blue	None		Blue 532-34	Green	White
RAW WATER	Apple Green	None		Apple Green 532-38	Green	White
SAMPLE LINE	Blue	None		Blue 532-34	Green	White
SAMPLE DRAIN	Light Gray	None		Cruiser Gray 532-31	Green	White
SCALE INHIBITOR	Orange	Light Green		Orange 536-29 Ivy Laurel T112-4	Yellow	Black
SCAVENGER SYSTEM DISCHARGE	Light Gray	Light Gray		Cruiser Gray 532-31	Yellow	Black
SANITARY SEWER	Dark Gray	None		Quarry Gray 532-32	Yellow	Black
SODIUM HYPOCHLORITE	Yellow	None		Yellow 536-35	Yellow	Black
SULFURIC ACID	Yellow	Red		Yellow 536-35 Red 536-28	Yellow	Black
STORM DRAIN	Light Gray	None		Cruiser Gray 532-31	Green	White
UTILITY WATER	Light Blue	None		Wood Lights 60-6W	Green	White
VENT AND DRAIN PIPES	Light Gray	None		Cruiser Gray 532-31	Yellow	Black

### 3.06 FACILITIES AND EQUIPMENT COLOR CODE SCHEDULE

<b>Service</b>	<b>Color</b>	<b>Example</b>	<b>Bruning Color Codes</b>
Tanks (and buildings)	Beige		Hacienda T144-4
Tank Trim	Green		Clifford Green
Chain, V-Belt & Coupling Guards	Yellow		Yellow 532-35
Gearbox and Motors	Light Gray		Cruiser Gray 532-31

END OF SECTION



## SECTION 40\_05\_00.09

### PIPING SYSTEMS TESTING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Test requirements for piping systems.
  - 1. Section 01\_33\_00 - Submittal Procedures.
  - 2. Section 40\_05\_00.01 - Common Work Results for General Piping.

##### 1.02 REFERENCES

- A. National Fuel Gas Code (NFGC).
- B. American Society of Mechanical Engineers (ASME):
  - 1. B31.1 - Power Piping.
  - 2. B31.3 - Process Piping.
  - 3. B31.8 - Gas Transmission and Distribution Piping Systems.
- C. Underwriters Laboratories Inc. (UL).

##### 1.03 TESTING REQUIREMENTS

- A. General requirements:
  - 1. Testing requirements are stipulated in Laws and Regulations; are included in the Piping Schedule in Section 40\_05\_00.01; are specified in the specifications covering the various types of piping; and are specified in this Section.
  - 2. Requirements in Laws and Regulations supersede other requirements of Contract Documents, except where requirements of Contract Documents are more stringent, including higher test pressures, longer test times, and lower leakage allowances.
  - 3. Test plumbing piping in accordance with Laws and Regulations, the plumbing code, as specified in Contract Documents, and UL requirements.
  - 4. Test natural gas piping:
    - a. For less than 125 pounds per square inch gauge working pressure, test in accordance with mechanical code, as specified in Contract Documents, or the National Fuel Gas Code, whichever is more stringent.
    - b. For 125 pounds per square inch gauge or greater working pressure, test per ASME B31.3 or ASME B31.8, whichever is more stringent.
  - 5. When testing with water, the specified test pressure is considered to be the pressure at the lowest point of the piping section under test.
    - a. Lower test pressure as necessary (based on elevation) if testing is performed at higher point of the pipe section.
- B. Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.

- C. Water for testing, cleaning, and disinfecting:
  - 1. Water for testing, cleaning, and disinfecting will be provided as specified in Contract Documents.
- D. Pipes to be tested: Test only those portions of pipes that have been installed as part of this Contract. Test new pipe sections prior to making final connections to existing piping. Furnish and install test plugs, bulkheads, and restraints required to isolate new pipe sections. Do not use existing valves as test plug or bulkhead.
- E. Unsuccessful tests:
  - 1. Where tests are not successful, correct defects or remove defective piping and appurtenances and install piping and appurtenances that comply with the specified requirements.
  - 2. Repeat testing until tests are successful.
- F. Test completion: Drain and leave piping clean after successful testing.
- G. Test water disposal: Dispose of testing water to the brine pond in accordance with requirements of federal, state, county, and city regulations governing disposal of wastes in the location of the Project and disposal site.

#### **1.04 SUBMITTALS**

- A. Submit as specified in Section 01\_33\_00.
- B. Schedule and notification of tests:
  - 1. Submit a list of scheduled piping tests by noon of the working day preceding the date of the scheduled tests.
  - 2. Notification of readiness to test: Immediately before testing, notify ENGINEER in writing of readiness, not just intention, to test piping.
  - 3. Have personnel, materials, and equipment specified in place before submitting notification of readiness.

#### **1.05 SEQUENCE**

- A. Clean piping before pressure or leak tests.
- B. Test gravity piping underground, including sanitary sewers, for visible leaks before backfilling and compacting.
- C. Underground pressure piping may be tested before or after backfilling when not indicated or specified otherwise.
- D. Backfill and compact trench, or provide blocking that prevents pipe movement before testing underground piping with a maximum leakage allowance.
- E. Test underground piping before encasing piping in concrete or covering piping with slab, structure, or permanent improvement.

## **PART 2 PRODUCTS**

Not Used.

## **PART 3 EXECUTION**

### **3.01 TESTING ALIGNMENT, GRADE, AND DEFLECTION**

- A. Alignment and grade:
  - 1. Visually inspect the interior of gravity piping with artificial light, reflected light, or laser beam.
  - 2. Consider inspection complete when no broken or collapsed piping, no open or poorly made joints, no grade changes that affect the piping capacity, or no other defects are observed.
- B. Deflection test:
  - 1. Pull a mandrel through the clean piping section under test.
  - 2. Perform the test not sooner than 30 days after installation and not later than 60 days after installation.
  - 3. Use a 9-rod mandrel with a contact length of not less than the nominal diameter of the pipe within 1 percent plus or minus.
  - 4. Consider test complete when the mandrel can be pulled through the piping with reasonable effort by 1 person, without the aid of mechanical equipment.

### **3.02 AIR TESTING METHOD FOR PRESSURE PIPING**

- A. Air test piping, indicated with "AM" in the Piping Schedule, with air or another nonflammable or inert gas.
- B. Test gas, air, liquefied petroleum gas, liquid chlorine, and chlorine gas piping by the air test method:
  - 1. Test chlorine piping with dry air or nitrogen having a dew point of minus 40 degrees Fahrenheit or less. Supply temporary air dryers as necessary.
- C. Test at pressure as specified in Piping Schedule in Section 40\_05\_00.01:
  - 1. Provide temporary pressure relief valve for piping under test:
    - a. Set at the lesser of 110 percent of the test pressure or 50 pounds per square inch gauge over the test pressure.
  - 2. Air method test pressures shall not exceed 110 percent of the piping maximum allowable working pressure calculated in accordance with the most stringent of ASME B31.1, ASME B31.3, ASE B31.8, or the pipe manufacturer's stated maximum working pressure.
  - 3. Gradually increase test pressure to an initial test pressure equal to the lesser of 1/2 the test pressure or 25 pounds per square inch gauge.
  - 4. Perform initial check of joints and fittings for leakage.
  - 5. Gradually increase test pressure in steps no larger than the initial pressure. Check for leakage at each step increase until test pressure reached.
  - 6. At each step in the pressure, examine and test piping being air tested for leaks with soap solution.
  - 7. Consider examination complete when piping section under test holds the test pressure for 15 minutes without losses.

### **3.03 TESTING GRAVITY FLOW PIPING**

Not Used.

### 3.04 TESTING HIGH-HEAD PRESSURE PIPING

- A. Test piping for which the specified test pressure in the Piping Schedule is 20 pounds per square inch gauge or greater, by the high head pressure test method, indicated "HH" in the Piping Schedule.
  
- B. General:
  - 1. Test connections, hydrants, valves, blowoffs, and closure pieces with the piping.
  - 2. Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.
  - 3. Do not include valves, equipment, or piping specialties in test sections if test pressure exceeds the valve, equipment, or piping specialty safe test pressure allowed by the item's manufacturer.
  - 4. During the performance of the tests, test pressure shall not vary more than plus or minus 5 pounds per square inch gauge with respect to the specified test pressure.
  - 5. Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.
  - 6. When test results indicate failure of selected sections, limit tests to piping:
    - a. Between valves.
    - b. Between a valve and the end of the piping.
    - c. Less than 500 feet long.
  - 7. Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.
  
- C. Testing procedures:
  - 1. Fill piping section under test slowly with water while venting air:
    - a. Use potable water for all potable waterlines and where noted on the Piping Schedule.
  - 2. Before pressurizing for the tests, retain water in piping under slight pressure for a water absorption period of minimum 24 hours.
  - 3. Raise pressure to the specified test pressure and inspect piping visually for leaks:
    - a. Consider visible leakage testing complete when no visible leaks are observed.
  
- D. Pressure test with maximum leakage allowance:
  - 1. Leakage allowance is zero for piping systems using flanged, National Pipe Thread threaded and welded joints.
  - 2. Pressure test piping after completion of visible leaks test.
  - 3. For piping systems using joint designs other than flanged, threaded, or welded joints, accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
    - a. Consider the pressure test to be complete when makeup water added is less than the allowable leakage and no damage to piping and appurtenances has occurred.
    - b. Successful completion of the pressure test with maximum leakage allowance shall have been achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.

- c. When leakage is allowed, calculate the allowable leakage by the following formula:

$$L = S \times D \times P^{1/2} \times 133,200^{-1}$$

wherein the terms shall mean:

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Average observed test pressure in pounds per square inches gauge, at the lowest point of the test section, corrected for elevation of the pressure gauge.

x = The multiplication symbol.

### **3.05 TESTING LOW-HEAD PRESSURE PIPING**

NOT USED -

END OF SECTION





## SECTION 40\_05\_31.01

### PLASTIC PIPING AND TUBING

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Plastic pipe, tubing, and fittings.
- B. Related sections:
  - 1. Section 43\_33\_21 – Chemical Feed, General
  - 2. Section 40\_05\_00.01 - Basic Piping Materials and Methods.
  - 3. Section 40\_05\_00.09 - Piping Systems Testing.

##### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
  - 1. B16.12 - Cast Iron Threaded Drainage Fittings.
- B. ASTM International (ASTM):
  - 1. D 1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
  - 2. D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
  - 3. D 1869 - Standard Specification for Rubber Rings for Asbestos-Cement Pipe.
  - 4. D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
  - 5. D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
  - 6. D 2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
  - 7. D 2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
  - 8. D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
  - 9. D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
  - 10. D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride)(PVC) Pipe and Fittings.
  - 11. D 3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - 12. D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
  - 13. D 4101 - Specification for Polypropylene Injection and Extrusion Materials.
  - 14. F 438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
  - 15. F 439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
  - 16. F 441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

17. F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  18. F 493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
  19. F 645 - Standard Guide for Selection, Design and Installation of Thermoplastic Water-Pressure Piping Systems.
  20. F 679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings..
- C. American Water Works Association (AWWA):
1. C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches to 12 Inches (100 mm Through 300 mm), for Water Transmission Distribution.
  2. C905 - Polyvinyl/Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inches through 36 inches, for water distribution.
- D. NSF International (NSF).
- E. Plastics Pipe Institute (PPI):
1. TR 31 - Underground Installation of Polyolefin Piping.

### 1.03 ABBREVIATIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. CPVC: Chlorinated polyvinyl chloride.
- C. DR: Dimension ratio.
- D. DWV: Drain, waste, and vent.
- E. ID: Inside diameter of piping or tubing.
- F. NPS: Nominal pipe size followed by the size designation.
- G. NS: Nominal SIZE of piping or tubing.
- H. PFA: Perfluoroalkoxy copolymer
- I. PP: Polypropylene.
- J. PTFE: Polytetrafluoro- ethylene
- K. PVC: Polyvinyl chloride.
- L. SDR: Standard dimension ratio; the outside diameter divided by the pipe wall thickness.

### 1.04 SUBMITTALS

- A. Product data: Describe materials, pipe, fittings, gaskets, and solvent cement.
- B. Manufacturer's Published Installation Instructions.

- C. Certificates:
  - 1. Submit manufacturer's certificate attesting that plastic pipe, tubing, and fitting types meet specified requirements:
  - 2. Manufacturer's certification of date of manufacture of plastic pipe and tubing for each lot delivered.
  - 3. Copies of solvent cement manufacturer's report and certification in accordance with ASTM D 2564 for PVC piping, and ASTM F 493 for CPVC piping.

## **1.05 QUALITY ASSURANCE**

- A. Plastic pipe in potable water applications: Provide pipe and tubing bearing NSF seal.
- B. Mark plastic pipe with nominal size, type, class, schedule, or pressure rating, manufacturer and all markings required in accordance with ASTM and AWWA standards.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect piping materials from sunlight, scoring, and distortion.
- B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees Fahrenheit.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Extruding and molding material: Virgin material containing no scrap, regrind, or rework material except where permitted in the referenced standards.
- B. Fittings: Same material as the pipe and of equal or greater pressure rating, except that fittings used in drain, waste, and vent piping systems need not be pressure rated.
- C. Unions 2-1/2 inches and smaller: Socket end screwed unions. Make unions 3 inches and larger of socket flanges with 1/8-inch full-face soft EPDM gasket.

### **2.02 PVC PIPING, SCHEDULE TYPE**

- A. Materials:
  - 1. PVC Pipe: Designation PVC 1120 in accordance with ASTM D 1785 and appendices:
    - a. Pipe and fittings: Extruded from Type I, Grade 1, Class 12454-B material in accordance with ASTM D 1784.
    - b. PVC Pipe: Schedule 80 unless otherwise indicated on the Drawings.
  - 2. Fittings:
    - a. Supplied by pipe manufacturer.
    - b. Pressure fittings: In accordance with ASTM D 2466 or ASTM D 2467.
    - c. DWV fittings: In accordance with ASTM D 2665.
  - 3. Solvent cement: In accordance with ASTM D 2564:

- a. Chemical service: For CPVC or PVC pipe in chemical service, provide the following primer and cement, or equal:
  - 1) Primer: IPS Corp Type P70.
  - 2) Cement: IPS Corp Type 724 cement or another cement certified by the manufacturer for chemical service.

### **2.03 NOT USED - PVC PIPING, CLASS TYPE**

### **2.04 NOT USED - PVC GRAVITY SEWER PIPING**

### **2.05 CPVC PIPING**

#### **A. Materials:**

- 1. CPVC pipe: Schedule 40 or Schedule 80, as specified, in accordance with ASTM F 441 and Appendix, CPVC 4120:
  - a. Pipe: Extruded from Type IV, Grade 1, Class 23447 material in accordance with ASTM D 1784.
  - b. Manufacturers: One of the following or equal:
    - 1) Charlotte Pipe and Foundry Company.
    - 2) Eslon Thermoplastics, Inc.
    - 3) Harvel Plastics, Inc.
- 2. Fittings: In accordance with ASTM F 438 or ASTM F 439 for pressure fittings, as appropriate to the service and pressure requirement:
  - a. Fittings: Supplied by the pipe manufacturer.
  - b. Manufacturers: One of the following or equal:
    - 1) Colonial Engineering.
    - 2) Eslon Thermoplastics, Inc.
    - 3) Chemtrol.
    - 4) Spears Manufacturing Company; or equal.
- 3. Solvent cement: In accordance with ASTM F 493:
  - a. For CPVC pipe in chemical service, utilize IPS Corp Type 724 cement or another cement certified by the manufacturer for high strength hypochlorite service.

### **2.06 PTFE TUBING FOR CHEMICAL SERVICE**

#### **A. Materials:**

- 1. Tubing: Scientific grade PTFE fluoropolymer tubing.
  - a. Manufacturers: One of the following:
    - 1) Saint Gobain Performance Plastics, Chemfluor 367
  - b. Tubing size: 3/4" ID, unless otherwise noted on Drawings.
  - c. Tubing fittings: Flared PFA fittings, Fit-Line FlareLINK or equal.

### **2.07 PE TUBING AND FITTINGS**

NOT USED

### **2.08 SOURCE QUALITY CONTROL**

- A. PVC piping, Schedule Type:
  - 1. Mark pipe and fittings in accordance with ASTM D 1785.
- B. CPVC piping:

1. Mark pipe and fittings in accordance with ASTM F 441.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. General:
  1. Where not otherwise specified, install piping in accordance with ASTM F 645, or manufacturer's published instructions for installation of piping, as applicable to the particular type of piping.
  2. Provide molded transition fittings for transitions from plastic to metal or IPS pipe. Do not thread plastic pipe.
  3. Locate unions where indicated on the Drawings, and elsewhere where required for adequate access and assembly of the piping system.
  4. Provide serrated nipples for transition from plastic pipe to rubber hose.
- B. Installation of PVC piping, Schedule Type:
  1. Solvent weld joints in accordance with ASTM D 2855:
    - a. For PVC pipe in chemical service use IPS Corp. Type 724 cement in accordance with manufacturer's instructions.
  2. Install piping in accordance with manufacturer's published instructions.
- C. Installation of CPVC piping:
  1. Clean dirt and moisture from pipe and fittings.
  2. Bevel pipe ends in accordance with manufacturer's instructions with chamfering tool or file. Remove burrs.
  3. Use solvent cement and primer formulated for CPVC:
    - a. For CPVC pipe in chemical service use IPS Corp. Type 724 cement in accordance with manufacturer's instructions.
  4. Use primer on pressure and non-pressure joints.
  5. Do not solvent weld joints when ambient temperatures are below 40 degrees Fahrenheit or above 90 degrees Fahrenheit unless solvent cements specially formulated for these conditions are utilized.
- D. Installation of Tubing for Chemical Service:
  1. Install tubing in accordance with manufacturer's published instructions.
  2. Tubing shall be installed as one continuous run of tubing. Tubing size shall be 3/4-inch ID, unless otherwise noted on Drawings. Tubing connections shall be installed at terminations of tubing.

END OF SECTION



## SECTION 40\_05\_51.01

### COMMON WORK RESULTS FOR VALVES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Basic requirements for valves.
- B. Related sections:
  - 1. Section 01\_33\_00 - Submittal Procedures.
  - 2. Section 43\_33\_21 – Chemical Feed, General

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA):
  - 1. C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings.
- B. ASTM International (ASTM):
  - 1. A 126 - Standard Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
  - 2. A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 3. A 536 - Standard Specification for Ductile Iron Castings.
- C. NSF International (NSF):
  - 1. 61 - Drinking Water System Components - Health Effects.
- D. Society for Protective Coatings (SSPC):
  - 1. SP 7 - Brush-Off Blast Cleaning.
  - 2. SP 10 - Near-White Blast Cleaning.

##### 1.03 DESIGN REQUIREMENTS

- A. Pressure rating:
  - 1. Suitable for service under minimum working pressures of 150 pounds per square inch gauge.
  - 2. When a piping system is specified in the Piping Schedule to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design working pressure which is sufficient to withstand the test pressure.
- B. Valve to piping connections:
  - 1. Valves 3 inch nominal size and larger: Flanged ends.
  - 2. Valves less than 3 inch nominal size: Screwed ends.
  - 3. Plastic valves in plastic piping:
    - a. Up to 2.5 inches: Provide solvent or heat welded unions.
    - b. 3 inches and above: Provide solvent or heat welded flanges.



## 1.04 SUBMITTALS

- A. Submit as specified in Section 01\_33\_00.
- B. Product data:
  - 1. Submit the following information for each valve:
    - a. Valve type, size, pressure rating, Cv factor.
    - b. Coatings.
    - c. Power valve actuators:
      - 1) Information on valve actuator including size, manufacturer, model number, limit switches, mounting; and motor enclosure, seating and unseating torque coefficient, dynamic torque, and bearing friction for calculation of maximum operating torque.
      - 2) Complete wiring diagrams and control system schematics.
    - d. Manual valve actuators:
      - 1) Information on valve actuator including size, manufacturer, model number.
    - e. Certified drawings with description of component parts, dimensions, weights, and materials of construction.
    - f. Certifications of reference standard compliance:
      - 1) Submit certification that the valves and coatings are suitable in potable water applications in accordance with NSF 61.
    - g. Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.
- C. Operation and maintenance data:
  - 1. Furnish bound sets of installation, operation, and maintenance instructions for each type of manual valve 4 inch in nominal size and larger, and all non-manual valves. Include information on valve operators in operation and maintenance instruction manual.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer qualifications:
  - 1. Valves manufactured by manufacturers whose valves have had successful operational experience in comparable service.

## 1.06 DELIVERY STORAGE AND HANDLING

- A. Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Stainless steel: In accordance with ASTM A 167, Type 316, or Type 304, UNS Alloy S31600 or S30400.
- B. Valve and operator bolts and nuts:
  - 1. Fabricated of stainless steel for the following installation conditions:
    - a. Submerged in sewage or water.

- b. In an enclosed space above sewage or water.
    - c. In structures containing sewage or water, below top of walls.
    - d. At openings in concrete or metal decks.
  - 2. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
  - 3. Underground bolts: Low-alloy steel in accordance with AWWA C111/A21.11.
- C. Bronze and brass alloys: Use bronze and brass alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.
- D. Valve bodies: Cast iron in accordance with ASTM A 126, Class 30 minimum or ductile iron in accordance with ASTM A 536, Grade 65-45-12 minimum unless specified otherwise.
- E. Plastic Valves
- 1. All valves shall be certified as completely compatible with the intended and specified service; compatibility shall apply to the material of the valve and internal components, including all seals, gaskets, O-rings and washers; solvents and primers used in the valve joint make-up shall be specifically in conformance with the written instructions of the valve supplier.
  - 2. Except as otherwise specified or noted on the Drawings, valve ends shall be true-union, socket-type designed for solvent welding. The valve manufacturer shall provide specific recommendations for solvent and primer.
  - 3. Valve material shall be the same as the piping service except as specified (refer to Section 43\_33\_21 for chemical service applications) or noted on the Drawings.
    - a. PVC shall be Type 1, Grade 1, per ASTM D178 classification, made from unplasticized polymer, generally suitable for service to 120 degrees F.
    - b. Polypropylene (PP) shall conform to the material requirements of ASTM D4101 for copolymer polypropylene.
    - c. The manufacturer of the valves shall retain material source quality documentation and shall furnish it to the Engineer upon request.
  - 4. Unless otherwise specified or noted in Section 43\_33\_21 (for chemical service) or on the Drawings:
    - a. O-rings, valve seats and stem seals shall be PTFE, or PTFE encapsulated elastomer. Alternative materials may not be substituted without complete documentation provided to the Engineer of service suitability.
    - b. Gaskets shall be low torque, full face and have two concentric, convex, molded rings between the center hole and bolthole circle. Gaskets shall be PTFE-bonded EPDM, Low Torque AV gaskets by Asahi of America, or equal.
    - c. Valve external hardware shall be Type-316 stainless steel. No internal metallic components shall be exposed to the service fluid.
    - d. No factory or field coatings shall be applied to the valves.
  - 5. All valves, except butterfly valves shall have a non-shock service pressure rating of not less than 120 psig at 70 degrees F.
  - 6. All valves shall be given hydrostatic pressure and leakage tests at the factory. Provide certified copy of test results.
  - 7. Valves specified as furnished with equipment, or equipment systems shall comply with these requirements.

## 2.02 INTERIOR PROTECTIVE LINING

- A. When specified in the particular valve specification, provide valves with type of protective lining specified in the particular valve Specification.
- B. Apply protective lining to interior, non-working surfaces, except stainless steel surfaces.
- C. Lining types:
  - 1. Fusion bonded epoxy:
    - a. Manufacturers: One of the following or equal:
      - 1) 3-M Company, ScotchKote 134; certified to NSF 61 for drinking water use.
    - b. Clean surfaces in accordance with SSPC SP 7 or SP 10, as recommended by epoxy manufacturer.
    - c. Apply in accordance with manufacturer's published instructions.
    - d. Lining thickness: 0.010 to 0.012 inches except that:
      - 1) Lining thickness in grooves for gaskets: 0.005 inches.
      - 2) Do not coat seat grooves in valves with bonded seat.
    - e. Quality control:
      - 1) Lining thickness: Measured with a non-destructive magnetic type thickness gauge.
      - 2) Verify lining integrity with a wet sponge-testing unit operating at approximately 60 volts, or as recommended by the lining manufacturer.
      - 3) Consider tests successful when lining thickness meets specified requirements and when no pinholes are found.
      - 4) Correct defective lining disclosed by unsuccessful tests, and repeat test.
      - 5) Repair pinholes with liquid epoxy recommended by manufacturer of the epoxy used for lining.
  - 2. High solids epoxy:
    - a. Product equivalent to high solids epoxy specified in the Contract Documents.
      - 1) Certified in accordance with NSF 61 for drinking water use.
      - 2) Interior: Coat valve interior with manufacturer's equivalent high performance high solids epoxy coating system with a certifiable performance history for the service conditions and as approved by the ENGINEER. Manufacturer shall provide for approval, coating information sufficient to allow ENGINEER to assess equivalence to the specified high solids epoxy coating specified in the Contract Documents.
    - b. Clean surfaces to meet SP-7 or SP-10, or as recommended by coating manufacturer.
    - c. Quality control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by coating manufacturer.
      - 1) Repair holidays and other irregularities and retest coating.
      - 2) Repeat procedure until holidays and other irregularities are corrected.

## **2.03 UNDERGROUND VALVES**

NOT USED -

## **2.04 VALVE BOXES**

NOT USED -

## **2.05 VALVE OPERATORS**

- A. Valve operator "Open" direction: Open counterclockwise.
- B. Provide valves located below operating level or deck with extensions for key operation or floor stands and handwheels.
- C. Provide manually operated valves located not more than 6 feet above the operating level with tee handles or handwheels. Where handwheels are provided, wheels shall be 18-inches in diameter.
  - 1. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
  - 2. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.
- D. Fit valves located more than 6 feet above operating level with chain operated handles or valve wheels.
  - 1. Chains: Sufficient length to reach approximately 4 feet above the operating level.
  - 2. Where chains constitute a nuisance or hazard to operating personnel, provide holdbacks or other means for keeping the chains out of the way.
- E. Provide an operator shaft extension from valve or valve operator to finished grade or deck level when buried valves, and other valves located below the operating deck or level, are specified or indicated on the Drawings to be key operated; provide 2 inch square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Preparation prior to installation:
  - 1. Install valves after the required submittal on installation has been accepted.
  - 2. Determine after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.
- B. Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

### 3.02 INSTALLATION

- A. Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.
- B. Where needed, furnish and install additional valves for proper operation and maintenance of equipment and plant facilities under the following circumstances:
  - 1. Where such additional valves are required for operation and maintenance of the particular equipment.
  - 2. Where such additional valves are required as a result of a substitution or change initiated.
- C. Install valves with their stems in vertical position above the pipe, except as follows:
  - 1. Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
- D. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.
- E. Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.
- F. Valves with threaded connections:
  - 1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.
  - 2. Apply pipe joint compound or Teflon tape on external (male) threads to prevent forcing compound into valve seat area.
- G. Valves with flanged connections:
  - 1. Align flanges and gasket carefully before tightening flange bolts.
  - 2. When flanges are aligned, install bolts and hand tighten.
  - 3. Tighten nuts opposite each other with equal tension before moving to next pair of nuts.
- H. Valves with soldered connections:
  - 1. Do not overheat connection to prevent damage to resilient seats and metal seat rings.
  - 2. Position valves in full open position before starting soldering procedure.
  - 3. Apply heat to piping rather than to valve body.

END OF SECTION

## **SECTION 40\_05\_63**

### **BALL VALVES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section includes: Metal body ball valves and plastic body ball valve.
- B. Related sections:
  - 1. Section 01\_33\_00 - Submittal Procedures.
  - 2. Section 40\_05\_00.01 - Common Work Results for General Piping.
  - 3. Section 40\_05\_51.01 - Common Work Results for Valves.
  - 4. Section 43\_33\_21 - Chemical Feed, General.

##### **1.02 REFERENCES**

- A. American Society of Mechanical Engineers (ASME):
  - 1. B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  - 2. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
- B. American Water Works Association (AWWA):
  - 1. C507 - Standard for Ball Valves 6 Inch Through 48 Inch.
- C. ASTM International (ASTM):
  - 1. A 48 - Standard Specification for Gray Iron Castings.
  - 2. A 216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
  - 3. A 351 - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.

##### **1.03 SYSTEM DESCRIPTION**

- A. General: Unless otherwise indicated on the Drawings use:
  - 1. Metal body ball valves on metallic pipelines.
  - 2. Plastic body ball valves on plastic pipelines.
  - 3. Do not use metal body ball valves in sodium hypochlorite or sodium bisulfite systems.

##### **1.04 SUBMITTALS**

- A. Shop drawings: Submit the following information as specified in Sections 01\_33\_00 and 40\_05\_51.01:
  - 1. Product data.
  - 2. Certificates:
    - a. Metal body ball valves: 6 inches and larger only. Submit affidavit of compliance in accordance with AWWA C507.
  - 3. Operation and maintenance data.

## **PART 2 PRODUCTS**

### **2.01 METAL BODY BALL VALVES, LESS THAN 6 INCH SIZE**

- A. Manufacturers: One of the following, or equal:
  - 1. Apollo Valves as manufactured by Conbraco Industries, Inc.
  - 2. Metso Automation/Jamesbury.
  - 3. NIBCO, Inc.
  
- B. General:
  - 1. Type: Non-lubricated, full port 3-piece ball valves capable of sealing in either direction.
  - 2. End connections:
    - a. Solder ends for sizes 3-inch and smaller.
    - b. Class 150 flanged for sizes larger than 3 inch.
      - 1) Flanges: In accordance with ASME B16.1 standards.
  - 3. Stem packing: Manually adjustable while valve is under pressure.
  - 4. Shafts:
    - a. Rigidly connected to the ball by a positive means.
      - 1) Design connection to transmit torque equivalent to at least 75 percent of the torsional strength of the shaft.
  - 5. Handles: Stainless steel latch lock handle with vinyl grip and stainless steel nut designed to open and close the valve under operating conditions.
  - 6. Temperature limits: Suitable for operation between minus 20 and 350 degrees Fahrenheit.
  
- C. Materials:
  - 1. Valves in copper lines: Bronze body.
  - 2. Valves in steel and ductile iron piping: Ductile iron or cast steel body.
  - 3. Valves in stainless steel piping: Stainless steel body, material type to match piping material as scheduled on the Drawings.
  - 4. Ball: 316 stainless steel.
  - 5. Seats: PTFE.
  - 6. Stem seals: PTFE or Viton.
  - 7. Bearings: Self-lubricated, corrosion resistant material that will not contaminate potable water.
  - 8. Valves for combustible fluid applications (digester gas, natural gas, fuel oil, etc.) must be of fire safe design.

### **2.02 PLASTIC BODY BALL VALVES**

- A. Manufacturers: One of the following or equal:
  - 1. Hayward
  - 2. Asahi America.
  - 3. Chemtrol Division, NIBCO, Inc.
  - 4. Plast-O-Matic Valves, Inc.
  
- B. General:
  - 1. Type: Non-lubricated and capable of sealing in either flow direction.
  - 2. End connections: True union; solvent or heat welded to piping.
  - 3. Operator handle: Lever.
  
- C. Materials:

1. Body, ball, seats and O-rings: Materials
  - a. General service applications: Polyvinyl chloride (PVC)
  - b. Chemical service applications; refer to Section 43\_33\_21 for suitable materials.
2. Ball:
  - a. General service applications: Polyvinyl chloride (PVC).
  - b. Chemical service applications: refer to Section 43\_33\_21 for suitable materials.
3. Seats:
  - a. General service applications: PTFE (Teflon).
  - b. Chemical service applications: refer to Section 43\_33\_21 for suitable materials.
4. O-rings:
  - a. General service applications: EPDM.
  - b. Chemical service applications: refer to Section 43\_33\_21 for suitable materials.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. General: Install each type of valve in accordance with manufacturers' printed instructions.
- B. Special techniques:
  1. PVC ball valves for hypochlorite service:
    - a. Provide valve with factory drilled 0.125-inch hole in the upstream side of the ball.
    - b. Provide an engraved plastic tag permanently attached to the valve stem stating "One side of ball drilled for hypochlorite service."

END OF SECTION





## SECTION 40\_05\_65.24

### CHECK VALVES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes:
  - 1. Plastic ball check valves.
  - 2. Plastic swing check valves.
- B. Related sections:
  - 1. Section 01\_33\_00 - Submittal Procedures.
  - 2. Section 40\_05\_51.01 - Common Work Results for Valves.
  - 3. Section 43\_33\_21 Need number – Chemical Feed, General

##### 1.02 REFERENCES

- A. American Water Works Association (AWWA):
  - 1. C508 - Standard for Swing-Check Valves for Waterworks Service 2 Inch Through 24 Inch (50-mm Through 600-mm) NPS.
- B. American Society of Mechanical Engineers (ASME):
  - 1. B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- C. ASTM International (ASTM):
  - 1. A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 2. A 313 - Standard Specification for Stainless Steel Spring Wire.
  - 3. B 582 - Standard Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip.
  - 4. B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

##### 1.03 SYSTEM DESCRIPTION

- A. Design requirements:
  - 1. Check valves: When not otherwise specified as indicated on the Drawings, provide check valves suitable for service as follows:
    - a. In either horizontal or vertical position.
    - b. Under pressures equal and less than 150 pounds per square inch gauge.

##### 1.04 SUBMITTALS

- A. Submit the following information as specified in Sections 01\_33\_00 and 40\_05\_51.01:
  - 1. Product data.
  - 2. Certificates:
    - a. General purpose AWWA check valves:

- 1) Affidavit of compliance attesting valves provided comply with all provisions in accordance with AWWA C508.
3. Operation and maintenance data.

## **PART 2 PRODUCTS**

### **2.01 CENTER GUIDE (SILENT) CHECK VALVES**

NOT USED

### **2.02 SWING CHECK VALVES**

NOT USED

### **2.03 SWING CHECK VALVES FOR REVERSE OSMOSIS SERVICE**

NOT USED

### **2.04 FLAPPER TYPE CHECK VALVES**

NOT USED.

### **2.05 SLANTING DISC CHECK VALVES**

NOT USED.

### **2.06 PLASTIC BALL CHECK VALVES**

- A. Manufacturers: One of the following or equal:
  1. Chemtrol Division of Nibco.
  2. R. G. Sloane Company, Inc.
- B. Valves: Ball type:
  1. Body: Compatible with service in accordance with Section 43\_33\_21.
  2. Double or single union-type end connections.
  3. Seals: Compatible with service in accordance with Section 43\_33\_21.

### **2.07 PLASTIC SWING CHECK VALVES**

- A. Manufacturers: One of the following or equal:
  1. Harrington
- B. Valves: Ball type:
  1. Body: Compatible with service in accordance with Section 43\_33\_21.
  2. Double or single union-type end connections.
  3. Seals: Compatible with service in accordance with Section 43\_33\_21.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install valves as specified in Section 40\_05\_51.01 and the manufacturer's instructions.

### **3.02 ADJUSTING**

- A. Adjust cushioned swing check valves in the field by means of external adjustment devices to minimize pressure surges.
- B. Adjust weight on swing check valves to affect proper closing action on equipment shutdown.

END OF SECTION



## SECTION 40\_05\_67.37

### PRESSURE REDUCING AND PRESSURE RELIEF VALVES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section includes: Pressure reducing and pressure relief valves chemical service.
- B. Related sections:
  - 1. Section 01\_33\_00 - Submittal Procedures.
  - 2. Section 40\_05\_51.01 - Valves.

##### 1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
  - 1. B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
- B. ASTM International (ASTM):
  - 1. A 48 - Standard Specification for Gray Iron Castings.
  - 2. A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - 3. A 536 - Standard Specification for Ductile Iron Castings.

##### 1.03 SUBMITTALS

- A. Shop drawings: Submit the following information as specified in Sections 01\_33\_00 and 40\_05\_51.01:
  - 1. Product Data.
  - 2. Operation and Maintenance Data.

#### PART 2 PRODUCTS

##### 2.01 AIR PRESSURE REGULATING VALVES

NOT USED

##### 2.02 PRESSURE REGULATING/RELIEF VALVES FOR CHEMICAL SERVICE

- A. Manufacturers: One of the following or equal:
  - 1. Plast-O-Matic, Series RVT.
  - 2. Asahi/America.
- B. Materials:
  - 1. Valve body: Match service piping material as indicated on the Drawings.
  - 2. U-cup seals:
    - a. Sulfuric Acid: Viton
  - 3. Adjusting bolt, locknut, control spring and fasteners: Stainless steel.
- C. Design:

1. Pressure rating: Not less than 150 pounds per square inch.
2. In-line design, size as indicated on the Drawings.
3. End connections:
  - a. 1 inch and smaller: Threaded.
  - b. Larger than 1 inch: Flanged.
4. Relief set point: Externally adjustable without removing valve from piping system. Set valve to open at 10 pounds per square inch more than pump discharge pressure at operating point, or as indicated on the Drawings.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with Section 40\_05\_51.01.

END OF SECTION

## SECTION 40 90 00

### PROCESS INSTRUMENTATION AND CONTROLS - GENERAL PROVISIONS

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. A single pre-approved system supplier (supplier) who shall furnish all services and equipment defined herein and in other Specification sections as listed below under related work.
- B. The supplier shall provide all materials, equipment, labor and services required to achieve a fully integrated and operational system. The supplier shall design and coordinate the instrument and control system for proper operation with related equipment and materials furnished by other suppliers under other sections of these Specifications and with related existing equipment.
- C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with existing equipment or equipment provided by other suppliers under other Sections of these Specifications, shall be included whether they are shown on the instrument drawings or not.
- D. Substitutions on functions or type of equipment specified will not be acceptable. In order to insure the interchangeability of parts, the maintenance of quality, the ease of interfacing between the various subsystems and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to insure compatibility between all equipment, it shall be the responsibility of the system supplier to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.
- E. Equipment shall be fabricated, assembled, installed and placed in proper operating condition in full conformity with detail Drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the ENGINEER.
- F. To facilitate the OWNER's future operation and maintenance, products shall be of the same major instrumentation manufacturer, with panel mounted devices of the same type and model as far as possible.
- G. All equipment shall be listed and labeled as defined in Article 100 of National Electrical Code, and shall satisfy applicable Federal, State and local codes. All control panels shall comply with Article 409 of National Electrical Code, UL508A, and shall satisfy applicable Federal, State and local codes. All installations shall be per National Electrical Code, and shall satisfy applicable Federal, State and local codes.
- H. Supplementing this Section, the Drawings and the related Specification sections provide additional details showing panel elevations, instrument device schedules, functional requirements of the system and interaction with other equipment.



## 1.02 RELATED WORK

- A. The supplier shall furnish all materials, labor and services specified in the following Specification sections as required to ensure a single, coordinated system is supplied:
  - 1. Section 40 91 00 - Process Instrumentation and Controls - Products
  
- B. The Supplier shall in particular coordinate his work with the work under the following:
  - 1. Division 11 – Equipment
  - 2. Division 26 – Electrical
  - 3. Division 40 – Process Integration
  
- C. Instrument and control systems supplied by the Supplier shall be designed and coordinated for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications and to related existing equipment.
  - 1. Verify following work not by I&C Supplier is provided:
    - a. Correct type, size, and number of signal wires with their raceways.
    - b. Correct electrical power circuits and raceways.
    - c. Correct size, type, and number of I&C related pipes, valves, fittings, and tubes.
    - d. Correct size, type, materials, and connection of process mechanical piping for in-line primary elements.
  - 2. For equipment not provided under I&C Supplier, but directly connected to equipment required by I&C Supplier:
    - a. Obtain from CONTRACTOR, manufacturer's information on installation, interface, connection, and adjustment.
    - b. Coordinate with CONTRACTOR to allow required interface and operation with I&C System.
    - c. For operation and control, verify that installations, interfacing signal terminations, and adjustments have been completed with manufacturer's recommendations.
    - d. Test to demonstrate required interface and operation with I&C System.
    - e. Examples of items in this category, but not limited to the following:
      - 1) Valve operators, position switches, and controls.
      - 2) Chemical feed pump and feeder speed/stroke controls.
      - 3) Automatic samplers.
      - 4) Motor control centers.
      - 5) Package control systems
  - 3. Adjustable speed drive systems

## 1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01\_33\_00. These shop Drawings shall fully demonstrate that the equipment and services to be furnished will comply with the provisions of these specifications and shall provide a true and complete record of the equipment as manufactured and delivered. Submittals shall be bound in separate three-ring binders, with an index and sectional dividers, with all Drawings reduced to a maximum size of 11-in by 17-in for inclusion within the binder. Separate submittals shall be made as follows:
  - 1. Project plan

2. Testing related subjects
3. OWNER training plan
4. Spares, expendable and test equipment
5. Process instrumentation and controls
6. Digital system hardware (programmable controllers, computers, peripherals, etc.)
7. Digital system software
8. Digital specific system software applications

The project plan shall be submitted and approved before any further submittals will be accepted.

- B. Project Plan: It shall provide an overview of the proposed system including system architecture diagrams, the approach to work, the proposed work schedule indicating milestones and potential meetings, project personnel and organization, details of factory testing and field testing, details of training programs and a paragraph by paragraph review of the specifications indicating any proposed deviations. The schedule shall illustrate all major project milestones including the following:
1. Schedule for all subsequent project submittals.
  2. Tentative dates for all project design review meetings.
  3. Schedule of manufacture and staging of all instrumentation and control system equipment.
  4. Schedule for factory acceptance test.
  5. Schedule for shipment of all instrument and control system equipment all peripheral devices.
  6. Schedule for equipment start up.
  7. Schedule for field acceptance test.
  8. Schedule for all training.
  9. The project plan must be submitted and approved before any future submittals are made.
- C. Testing Related Submittals
1. Test Procedures: Submit the procedures proposed to be followed during the test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests.
    - a. Preliminary test procedure submittals: Prior to the preparation of the detailed test procedures, submit outlines of the specific proposed tests. Submittals shall include examples of the proposed forms, checklists, and layout of testing equipment and wiring diagrams.
    - b. Test Procedure Submittals: After the preliminary test procedure submittals have been reviewed by the ENGINEER and returned stamped either "approved" or "approved as noted, confirm" submit the proposed detailed test procedures. Following this, the tests may be started.
  2. Test Documentation: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures.
- D. OWNER Training Plan - Submittals
1. In accordance with Section 01\_75\_17.
  2. Preliminary training plan submittal:
    - a. Within 120 days of contract award to the CONTRACTOR, submit an overview of the proposed training plan. This overview shall include, for each course proposed:

- 1) An overview of the training plan explaining why specific courses are proposed.
  - 2) Course title and objectives.
  - 3) Prerequisite training and experience of attendees.
  - 4) Recommended types of attendees.
  - 5) Course Content - A topical outline.
  - 6) Course Duration.
  - 7) Course Location - Training center or jobsite.
  - 8) Course Format - Lecture, laboratory demonstration, etc.
- b. The ENGINEER will review the preliminary training plan submittal with the OWNER.
3. Training Plan Submittal: Upon receipt of the OWNER's and ENGINEER's comments on the preliminary training plan, submit the specific proposed training plan. The training plan shall include:
- a. Definitions of each course.
  - b. Specific course attendance.
  - c. Schedule of training courses including dates, duration and locations of each class.
  - d. Resumes of the instructors who will actually implement the plan.
- E. Spares, Expendables, and Test Equipment Lists Submittal
1. This submittal shall include for each Subsystem:
    - a. A list of, and descriptive literature for, spares, expendables and test equipment as specified for each Instrumentation Section (Sections 40\_90\_00 and 40\_91\_00).
    - b. A separate list of, and descriptive literature for, additional spares, expendables and test equipment recommended by the System Supplier.
    - c. Unit and total costs for the additional spare items recommended for each subsystem.
    - d. Provide storage instructions for all spare parts.
- F. Process Instrumentation and Controls
1. This submittal shall provide complete documentation of all field instruments, control panels and other instrument and control equipment not specified to be submitted elsewhere.
    - a. Provide detailed loop diagrams on a single 11-in by 17-in or 8.5-in by 11-in sheet for each monitoring or control loop. The loop diagram shall show all components of the loop both analog, digital and discrete including all relays, switches, dropping resistors, etc which are being provided for proper operation. Loop numbers used shall correspond to the loop numbers indicated in the contract documents. The format shall be the Instrument Society of America, Standard for Instrument Loop Diagrams, ISA-S5.4 plus the following requirements:
      - 1) Instrument loop diagrams shall be approved by a licensed engineer proficient in instrumentation design.
      - 2) On each diagram present a tabular summary of 1) the output capability of the transmitting instrument, 2) the input impedance of each receiving instrument, 3) an estimate of the loop wiring impedance based on wire sizes and approximate length used, 4) the total loop impedance, 5) reserve output capacity.
    - 3) Show all interconnecting wiring between equipment, panels, terminal junction boxes and field mounted components. The diagrams shall

- show all components and panel terminal board identification numbers and all wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g. terminal junction boxes). The diagrams shall be coordinated with the electrical supplier and shall bear his/her mark showing this has been done.
- 4) Show location of all devices.
  - 5) Show instrument description showing type, manufacturer, model number, range, setpoints and operation (e.g. fail open, open on energization, normally closed, etc) as applicable.
  - 6) Show all instrument loop power or instrument air requirements back to termination on terminal block or bulkhead, fuse block (including fuse size), etc, as applicable.
  - 7) Show all grounding points within cabinets and panels and identify the connection point of individual components.
- b. Provide detailed Drawings covering control panels consoles and/or enclosures which shall include:
- 1) Cabinet assembly and layout Drawings to scale. These shall include both front and interior layouts.
  - 2) Material, fabrication and painting specifications.
  - 3) Color selection samples for selection by the ENGINEER.
  - 4) Where graphic display panels are required, submit detailed layout to scale, including symbols and line widths, as well as color selection samples and details of fabrication. Half-scale layout will be acceptable.
  - 5) Panel wiring diagrams showing all power connections to equipment within and on the panel, combined panel power draw requirements (volts, amps), breaker sizes, fuse sizes and grounding. This wiring diagram shall be in ladder logic format and shall reference the appropriate loop drawing for continuations or details where required. Show all wire numbers, and terminal block designations.
- c. The submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards and equipment layouts in order to enable the CONTRACTOR to proceed with the detailed site preparation for all equipment.
- G. Digital System Hardware (Programmable Controllers, Computers, Peripherals, etc.)
1. This submittal shall provide complete documentation of the proposed hardware including:
    - a. A complete system block diagram(s) showing in schematic form, the interconnections between major hardware components such as; control centers, panels, power supplies, consoles, computer and peripheral devices, telemetry equipment, local digital processors and like equipment. The block diagram shall reflect the total integration of all digital devices in the system and shall reflect any man/machine interface locations. All components shall be clearly identified with appropriate cross references to the location of each. The diagram shall reference all interconnecting cabling requirements for digital components of the system including any data communication links.
    - b. Data sheet for each hardware component listing all model numbers, optional, auxiliary and ancillary devices that are being provided. The data sheets shall be provided with an index and proper identification and cross

referencing. They shall include but not be limited to the following information.

- 1) Plant Equipment Number and ISA tag number per the Loop Diagrams (as applicable).
  - 2) Product (item) name used herein and on the Contract Drawings.
  - 3) Manufacturer's complete model number.
  - 4) Location of the device.
  - 5) Input - output characteristics.
  - 6) Range, size and graduations.
  - 7) Physical size with dimensions, enclosure NEMA classification and mounting details.
  - 8) Materials of construction of all components.
  - 9) Power supply device sizing calculations where applicable.
- c. Equipment specification sheets which shall fully describe the device, the intended function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification sheets shall include the following:
- 1) Dimensions and working clearances.
  - 2) Mounting or installation details.
  - 3) Connection diagrams.
  - 4) Electrical power requirements (volts, amps).
  - 5) Materials of construction.
  - 6) Environmental characteristics.
  - 7) Performance characteristics.
- d. Detailed drawings covering control consoles and/or enclosures which shall include:
- 1) Cabinet assembly and layout Drawings to scale. These shall include both front and rear layouts.
  - 2) Fabrication and painting specifications.
  - 3) Color selection samples for selection by the ENGINEER.
  - 4) Panel wiring diagrams showing all power connections to equipment within and on the enclosure, combined panel power draw requirements (volts, amps), breaker sizes, fuse sizes and grounding.
- e. The System Hardware submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards and equipment layouts in order to enable the CONTRACTOR to proceed with the detailed site preparation for all equipment.

H. Digital System Software:

1. The Software Functional Design submittal shall provide a complete description of the system on a functional level. The software shall be organized into functional subsystems. The intent of the Software Functional Design submittal shall be to describe, in detail, what functions are to be performed by each subsystem. It is not the intent of this documentation to describe the individual programs that support these functions.
2. The Software Functional Design submittal shall include, but not be limited to, the following items for each subsystem:
  - a. System Database - A complete database for all system I/O points as described in Contract Documents.

- b. Subsystem Abstract - A brief overview of the subsystem which shall describe its major functions.
  - c. Technical Description - A description of all the functions to be performed by the subsystem. This description shall indicate how the functions work from a user's standpoint.
  - d. Subsystem Structure - A diagram of the overall subsystem indicating major modules, data structures and data flow. It shall also be defined whether the function is performed in the central system, a remote unit or both.
  - e. Interface Structure - A diagram and/or description of the manner in which the subsystem interfaces with other subsystems.
  - f. Man-Machine Interface Consideration - A detailed description of all interface between the system and the operator shall be provided. All related CRT formats shall be shown.
  - g. Initialization Considerations - A description of the impact of power fail or system failover type restarts upon the subsystem shall be described.
3. The Software Functional Design Documentation shall also include a functional description of all support software as described in this Specification. As with the previous subsystems, this Software Functional Design submittal shall describe what functions are performed by each software support subsystem. This documentation shall describe what functional subsystems and data bases are affected by each support software subsystem.
  4. This software submittal shall not cover the detailed control algorithms, plant reports, or process graphic displays. These shall be included in a subsequent submittal after the system supplier has met with the ENGINEER and OWNER and developed the specifics of these for the plant.

I. Specific Digital System Applications

1. This submittal shall cover the specific plant control schemes as well as the details of the plant reports and process graphic displays, that the system supplier has previously developed through meetings with the ENGINEER and OWNER.
2. Any functional part of any loop that is implemented in software may either be shown on the same loop connection diagram or on a separate supplemental "loop software diagram". In either case, software diagramming shall be provided for each loop included herein. The software diagramming and the actual program shall be cross referenced and well annotated. Symbology for software diagramming shall utilize one of the following methods. (Note this may or may not be the actual programming language used):
  - a. Ladder Diagram Format - This method may be used for programmable controllers only. The use of ladder diagrams to show logic in computer or microprocessors that cannot be programmed in ladder logic is not acceptable. Ladder diagram formats which depict analog control functions or which utilize subroutines, special programming control blocks, etc, shall be further described utilizing one of the following formats (formats b thru e) as is applicable.
  - b. Flow Chart Format - This method shall utilize symbology and conventions set forth in ANSI X3.5.
  - c. Binary Logic Format - This method shall utilize the symbology and conventions set forth in ISA Standard S5.2. (Latest Edition).
  - d. Structured Logic Format - This method shall utilize structured logic statements; if/and, and/or, etc.

- e. Graphic Symbolic Representation Format - Symbolic representation of functions of digital systems shall be as set forth in ISA Standard S5.3.
- 3. Included with each diagram shall be:
  - a. Brief description of the Control Function.
  - b. Listing of all scanned inputs to the control function.
  - c. A short narrative of the control strategy.
  - d. Any assumptions made in developing the program.
  - e. Listing of all outputs (i.e., AO, DO) from the control function.
  - f. Listing of all operator inputs/outputs to and from the control function. Any special CRT displays related to the function shall be illustrated. A description of the operation of any panels shall be described as it relates to the control function.
  - g. Failure contingencies shall be described in detail.
  - h. Cross references to appropriate loop drawings and other programs.
- 4. The specifics of the logs, reports and process graphic displays shall be developed by the system supplier in conjunction with the ENGINEER and OWNER. The types and quantities are described in the Specification. The specifics of what shall appear on each and what calculations are required to support them shall be developed and submitted in final printed form for approval.

#### **1.04 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM).
  - 1. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- B. Instrument Society of America (ISA)
  - 1. ISA S5.2 - Binary Logic Diagrams for Process Operations
  - 2. ISA S5.3 - Graphic Symbols for Distributed Control/Shared Display Instrumentation Logic and Computer Systems.
    - a. ISA S5.4 - Standard Instrument Loop Diagrams
- C. American National Standards Institute (ANSI)
  - 1. ANSI X3.5 - Flowchart Symbols and Their Usage in Information Processing
- D. National Electrical Manufacturers Association (NEMA)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### **1.05 QUALITY ASSURANCE**

- A. The supplier shall be instrumentation contractor with minimum 5 years experience in RO Water Treatment plants and participate in at least two RO Water Plant constructions.

#### **1.06 SYSTEM DESCRIPTION**

- A. The system shall provide monitoring and supervisory control for RO Concentrate Acid System.

- B. It shall contain all equipment necessary to monitor all inputs and control parameters of the RO Concentrate Acid System. The control system shall be capable of local and SCADA system manual control and full automatic control. In automatic control mode, it shall be fully automatic, capable of "Hands-Off" operation over 0-100% production rates based on monitored plant demand needs.
- C. The control system shall be designed to allow online calibration and repair of instruments used in the RO Concentrate Acid System control scheme without disruption of the plant process or production rate. This shall be accomplished using operator selectable process hold values in conjunction with operator selectable hold timers and alarms to remind operators to reset the system to active inputs.
- D. The RO Concentrate Acid control system shall be designed with sufficient delay timers and process verification logic to prevent inadvertent plant trips on process spikes and minor power fluctuations.
- E. All alarms that are generated by the PLC for RO Concentrate Acid System and have active roll in PLC logic, shall be latched, and shall be resetable from the HMI screens, except the alarms that need to be reset on the field.
- F. All alarms that are generated by the PLC for RO Concentrate Acid System and have only monitoring purposes, shall be present only while the conditions that caused the alarm are present, and be automatically reset when the conditions are no longer present.
- G. All flow pacing controls (or pacing controls of any kind) shall include a ratio factor that can be entered from the screens. Also, PLC programmer shall leave the option of adding calculation blocks for all pacing controls as required.

## **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Shipping Precautions
  - 1. After completion of shop assembly, factory test and approval all equipment, cabinets, panels and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at job site.
  - 2. Special instructions for proper field handling, storage and installation required by the manufacturer for proper protection, shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other acceptable means of protection.
  - 3. None of the central control and monitoring equipment shall be shipped to the site until the room(s) are environmentally suitable.
  - 4. All equipment supplied shall be shipped to the job site via dedicated air ride van.
- B. Identification



1. Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.
2. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.

C. Storage

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR at his/her own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the ENGINEER. This shall be at the cost and expense of the CONTRACTOR, or the apparatus shall be replaced by the CONTRACTOR at his/her own expense.

## 1.08 MAINTENANCE

A. Spare Parts:

1. Spare parts shall be as defined in the related specification sections. All spare parts shall be new and unused.
2. All spare parts shall be individually packaged and labeled.
3. The spares listed above shall be packed in a manner suitable for long-term storage and shall be adequately protected against corrosion, humidity and temperature.

## 1.09 FINAL SYSTEM DOCUMENTATION

- A. Prior to final acceptance of the system and OWNER training, operating and maintenance manuals covering instruction and maintenance on each type of equipment shall be furnished in accordance with the Section 01\_78\_23.
- B. The instructions shall be bound in three-ring binders with Drawings reduced or folded for inclusion and shall provide at least the following as a minimum.
1. A comprehensive index.
  2. A complete "As Constructed" set of approved shop Drawings.
  3. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.
  4. Full specifications on each item.
  5. System schematic drawings "As Constructed", illustrating all components, piping and electrical connections of the systems supplied under this Section.
  6. Detailed service, maintenance and operation instructions for each item supplied.
  7. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
  8. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

9. Complete parts lists with stock numbers and name, address and telephone number of the local supplier.
- C. The supplier's final documentation shall be new documentation written specifically for this project, but may include standard and modified standard documentation. Modifications to existing hardware or software manuals shall be made on the respective pages or inserted adjacent to the modified pages. All standard documentation furnished shall have all portions that apply clearly indicated. All portions that do not apply shall be lined out.
  - D. The manuals shall contain all illustrations, detailed drawings, wiring diagrams and instructions necessary for installing, operating and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.
  - E. If the supplier transmits any documentation or other technical information which he/she considers proprietary, such information shall be designated. Documentation or technical information which is designated as being proprietary will be used only for the design, construction, operation, or maintenance of the system and, to the extent permitted by law, will not be published or otherwise disclosed.
  - F. The requirements for the supplier's final documentation are as follows:
    1. As built documentation shall include all previous submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Field Acceptance Tests shall be incorporated in this documentation.
    2. The Hardware Maintenance Documentation shall describe the detailed preventive and corrective procedures required to keep the system in good operating condition. Within the complete Hardware Maintenance Documentation, all hardware maintenance manuals shall make reference to appropriate diagnostics, where applicable, and all necessary timing diagrams shall be included. A maintenance manual or a set of manuals shall be furnished for all delivered hardware, including peripherals. The Hardware Maintenance Documentation shall include, as a minimum, the following information:
      - a. Operation Information - This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.
      - b. Preventative-Maintenance Instructions - These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines and the adjustments necessary for periodic preventive maintenance of the System.
      - c. Corrective-Maintenance Instructions - These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause and instructions for remedying the malfunction.
      - d. Parts Information - This information shall include the identification of each replaceable or field-repairable module. All parts shall be identified on a list

in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross-references between system supplier's part number and manufacturer's part numbers shall be provided.

3. The Software Maintenance documentation shall provide a detailed description of the entire software system. This documentation shall be sufficient for software maintenance and modification of the entire software system. The following items shall be included with the software maintenance documentation.
  - a. Computer Manufacturer's User Manuals - All computer manufacturer's manuals applicable to the system being provided.
  - b. System Supplier's User Manuals - All applicable software manuals developed by the system supplier for the application software shall be provided.
  - c. Application/Custom Software Manuals - These manual(s) shall include all software maintenance information not included in the computer manufacturer's and system supplier's standard manuals. Each custom program developed specifically for the system shall include the following information as a minimum:
    - 1) Table of Contents
    - 2) Overview of the program
    - 3) Narrative describing exactly how the program works. All calculations, references to process I/O points and operator inputs should be mentioned.
    - 4) A flowchart shall be provided to clarify the narrative description.
    - 5) A List of Variables used by the program including the function of each. A cross reference to the Software Functional Design Documentation shall be provided where appropriate.
  - d. Software Listings - Two sets of well-annotated program listings of all software provided shall be furnished for all software items. These shall include, but not be limited to, the following:
    - 1) All listings associated with the system generation and software configuration of the specific system (i.e., system parameterization tables, build maps, disk maps, etc).
    - 2) Listings of all data bases configured for and associated with the system.
    - 3) Listing of all custom or modified software developed specifically for the system.
    - 4) These listings shall reflect any changes made after the factory acceptance test.
  - e. Machine Readable Documentation - The supplier shall provide two sets of the following as-built documentation in machine readable format:
    - 1) Disk Pack(s) of the entire as-built software system in object format ready to mount and execute on the system. If the proposed configuration does not include removable disk packs, this requirement shall be fulfilled with transportable storage media compatible with the system furnished such as magnetic tape on floppy disk.
    - 2) Source tapes of disk packs of the entire software system. The facility to easily locate any source program and obtain the corresponding hardcopy listing shall also be provided.

- 3) The machine readable documentation shall be 100 percent compatible with the Software Listings previously defined. As with the Software Listings, any changes made during or after factory acceptance test shall be reflected in both the media.
- f. Retrofit Documentation - The OWNER recognizes the fact that not all possible problems related to real-time events, software interlocks, flags, active tasks and hardware utilizations can be discovered during the Acceptance Tests. Therefore, the supplier shall investigate, diagnose, repair, update and distribute all pertaining documentation of the deficiencies which become evident during the warranty period. All such documentation shall be submitted to the OWNER within 30 days of solving the problem.
4. Provide Operator's Manuals for the system operators. These manuals shall be separately bound and shall contain all information necessary for the operator to operate the system. The manuals shall be written in nontechnical terms and shall be organized for quick access to each detailed description of the operator's procedure. Manuals shall contain, but not be limited to, the following information:
  - a. A simple overview of the entire system indicating the function and purpose of each piece of equipment.
  - b. A detailed description of the operation of the Process Operator Console including all appropriate CRT displays.
  - c. A detailed description of the operation and interface of all hardwired panels.
  - d. Complete step-by-step procedures for starting up and shutting down the entire system.
  - e. Complete step-by-step procedures for starting up or shutting down an individual component.
  - f. A complete description for operating all computer system equipment (i.e., CPU, tape unit, disk drive, etc).
  - g. Procedures for changing paper, tape, etc.
  - h. A complete description of the operation of each plant control function. All operator input to these functions shall be described.
  - i. A listing of all data base point names with their respective point descriptions.
  - j. A complete glossary of terms.

#### **1.10 PARTIAL PAYMENT SCHEDULE**

- A. The partial payments to the CONTRACTOR for work provided under this section shall satisfy the following limiting criteria (percent of the lump sum pay for all items and related requirements provided under this section):
  1. Approval of all required submittals (excluding O&M manuals) - 10 percent
  2. Completion of all factory acceptance tests - 20 percent
  3. Delivery of equipment to job site and properly stored - 20 percent
  4. Installation and functional acceptance tests - 30 percent
  5. Completion of training and delivery of final approved O&M manuals - 10 percent
  6. Completion of 30-day acceptance test and substantial completion - 10 percent
- B. Each item above shall be completed in full before any partial payment is made for that item.

## **PART 2 PRODUCTS**

### **2.01 INSTRUMENTATION GENERAL**

#### **A. Type**

1. All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water and wastewater industries.
2. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mA dc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1-5V dc (volts direct current), or the like.
3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.
4. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.
5. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Electrical Drawings, to comply with the National Electrical Code.
6. All indicators and recorder readouts shall be linear in process units, unless otherwise noted.
7. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent.
8. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for their purpose, to assure optimum long term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.
9. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.
10. The Digital Control Center equipment shall be installed in an air-conditioned area; however, the equipment furnished shall be designed to operate satisfactorily between 60 degrees F and 85 degrees F and up to 90 percent relative humidity assuming no condensation will occur.
11. The field mounted digital system equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.
12. All electronic/digital equipment shall be provided with radio frequency interference protection and shall be FCC approved.
13. All cables provided under this section shall be rated for environment. Wet locations shall include conduits systems below grade rated.

#### **B. Electrical:**

1. All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 117 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplied required for compliance

with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.
3. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

## **2.02 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) PROTECTION**

### **A. GENERAL:**

1. TVSS protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance free and self-restoring.
2. Instruments shall be housed in a suitable case, properly grounded. Ground wires for all TVSS shall be connected to a good earth ground and where practical, each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure or a separate NEMA 4X junction box coupled to the enclosure.

### **B. POWER SUPPLY:**

1. Protection of all 120 VAC instrument power supply lines shall be provided. Control panels shall be protected by line noise suppressing isolation transformers and TVSS. Field instruments shall be protected by TVSS.. For control panels, the line noise suppressing isolation transformer shall be Topaz Series 30 Ultra isolators or approved equal. The suppressor shall be Edco HSP-121 or approved equal.

### **C. ANALOG SIGNALS:**

1. Protection of analog signal lines originating and terminating not in the same building shall be provided by TVSS. For analog signal lines the TVSS shall be Edco PC-642. For field mounted two-wire instruments the TVSS shall be encapsulated in stainless steel pipe nipples, and shall be Edco SS64 series.
2. For field mounted four-wire 120VAC instruments, the TVSS shall be in a NEMA 4X polycarbonate enclosure, Edco SLAC series or approved equal.

## **2.03 TUBING AND FITTINGS**

- A. All instrument air header takeoffs and branch connections less than 2-in shall be 316 stainless steel.
- B. All instrument shut-off valves and associated fittings shall be supplied in accordance with the piping specifications and all instrument installation details. Fittings shall be Swagelok 316 stainless steel or equal and valves shall be Whitney 316 stainless steel or equal.
- C. All instrument tubing shall be fully annealed ASTM A269 Seamless 316 grade free of OD scratches having the following dimensional characteristics as required to fit the specific installation:
  1. 1/4-in to 1/2-in O.D. by 0.035 wall thickness.

2. 5/8-in to 1-in O.D. by 0.049 wall thickness.
  3. 1-in O.D. by 0.065 wall thickness.
  4. 1-1/4-in O.D. by 0.065 wall thickness.
  5. 1-1/2-in O.D. by 0.083 wall thickness.
  6. 2-in O.D. by 0.95 wall thickness.
- D. All process connections to instruments shall be annealed 1/2-in O.D. stainless steel tubing, Type 316.
- E. All tubetrack shall be supported by FRP unistrut and installed as per manufacturer's installation instructions.

## **2.04 CONTROL PANELS, ENCLOSURE AND CABINETS**

- A. The following Paragraphs describe general fabrication requirements of control panels, enclosures, consoles and cabinets.
- B. Pneumatic Tubing
1. Pneumatic tubing shall be a minimum of 1/4-in O.D. copper with compression fittings. All tubing shall be rigidly supported and run in horizontal or vertical planes. All pneumatic equipment shall be provided with separate shut-off valves. Flexible polyethylene tubing shall be used on all devices mounted on hinged doors, etc. A screened vent shall be provided on all enclosures using pneumatic instruments.
- C. Wiring
1. All interconnecting wiring, except for electronic circuits, shall have 600 volt insulation and rated for not less than 90 degrees C.
  2. Power distribution wiring on the line side of fuses shall be 12 AWG minimum. Control wiring on the secondary side of fuses shall be 14 AWG minimum. Electronic analog circuits shall utilize 16 AWG shielded, twister pair, cable insulated for not less than 300 volts.
  3. Power and low voltage dc wiring systems shall be routed in separate wireways. Crossing of different system wires shall be at right angles. Different system wires routed parallel to each other shall be separated by at least 12-in. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs shall not be filled to more than 60 percent visible fill.
  4. All wiring shall terminate in a master terminal board, rigid type and numbered. The master terminal board shall have a minimum of 25 percent spares. Terminal blocks shall be arranged in vertical rows and separated into groups. (Power, AC control, DC signal, alarm, and graphic). Terminal blocks shall be barrier type with the appropriate voltage rating (600 volts minimum). They shall be the raised channel mounted type. Wire connectors shall be the hook fork type with non-insulated barrel for crimp type compression connection to the wire. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers. Direct interlock wiring between equipment will not be allowed. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-in of the side panel or adjacent terminal.
  5. All wiring to hand switches and the like which are live circuits independent of the panel's normal circuit breaker protection shall be clearly identified as such.

6. All wiring shall be clearly tagged and color coded. All tag numbers and color coding shall correspond to the panel wiring diagrams and loop drawings. All power wiring, control wiring, grounding and dc wiring shall utilize different color insulation for each wiring system used.
7. Each control loop or system shall be individually protected by fuses or breakers. All protecting devices shall be clearly labeled and located for ease of maintenance.
8. Provide surge protectors on all incoming power supply lines at each panel.

D. Equipment Mounting/Arrangement

1. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Components mounting shall be oriented in accordance with the internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with the drawing, specifications and supplier's data.
2. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, etc, required to maintain the NEMA rating of the panel.
3. All Fiber Optic Cable shall terminate in fiber optic patch panels. Provide Fiber Optic jumpers as require for equipment.

E. Nameplates

1. All panels shall be supplied with suitable nameplates which identify the panel and individual devices as required.

F. Painting

1. All sections shall be descaled, degreased, filled, ground and finished. The enclosure when fabricated of steel shall be finished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel and FRP panels will not require a paint finish.

G. Freestanding Vertical Panels or Computer Consoles

1. Freestanding vertical panels and computer consoles shall be of NEMA 12 construction and be labeled by underwriters laboratories. The panels shall be constructed of 11 gauge thick sheet steel, suitably braced internally for structural rigidity and strength. All exposed welds, seams, or edges shall be ground smooth. Front panels or panels containing instruments shall be not less than 7 gauge thick stretcher leveled sheet steel, reinforced to prevent warping or distortion.
2. Freestanding vertical panels located outdoor, rooms below grade, damp, wet or corrosive areas shall be NEMA 4X 316SS. Panels located in controlled environment areas shall be NEMA 12 painted steel.
3. All outdoor panels shall be provided with sunshields and shall face north.
4. Panels shall be provided with full length rear doors or front access doors as shown on the panel details. Full length rear access door shall be not greater than 24-in in width. Front access doors with mounted instruments or control



devices shall be of sufficient width to permit door opening without interference from flush mounted instruments. All doors shall be mounted with strong, continuous, piano type hinges and be provided with lockable door handles and three point latches.

5. Approximate size and equipment layout is shown on the panel details.
6. Provide overhead switched lighting and at least one convenience receptacle in each panel.
7. The panel shall be suitable for top or bottom conduit entry as required by the Electrical Drawings. For top mounted conduit entry the panel top shall be provided with nominal one foot square removable access plates which may be drilled to accommodate conduit and cable penetrations. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts, or other accessories as required to maintain the NEMA rating of the panel and electrical rating of the conduit system.

#### H. Wall or Unistrut Mounted Cabinets

1. Unless noted other wise on the Contract Drawings, all indoor panels shall be minimum of NEMA 12 and fabricated of FRP. All outdoor panels specified as having a NEMA 4X rating shall be constructed of 316 stainless steel. All indoor panels specified as having a minimum NEMA 12 rating shall be FRP. All FRP panels located in direct sunlight shall be provided with a protective coating to prevent discoloration and cracking.
2. All panels shall be as manufactured by Hoffman, or equal.

#### I. Sample Panels:

1. Sample Panels Furnished by Instrumentation design builder
2. .
  - a. Sample Panel - Raw Water:
    - 1) Quantity: 1.
    - 2) Drawing Reference: 02-M-05, Detail 3.
    - 3) Location:
      - a) Building: RO Building No. 2.
      - b) Area: 02
  - b. Sample Panel - Finished Water:
    - 1) Quantity: 1.
    - 2) Drawing Reference: 02-M-05, Detail 4.
    - 3) Location:
      - a) Building: Degasifier/Scrubber Area
      - b) Area: 03
3. General:
  - a. Materials:
    - 1) Construct sample panels of FRP flat sheets and parts.
    - 2) Structural components shall be FRP structural shapes complying with ASTM D-570 for water adsorption.
    - 3) Enclosures and junction boxes shall be NEMA 4X, FRP construction, by Hoffman or equal.
  - b. Fasteners: FRP rivets or, where required by the structural engineer, FRP bolts and nuts.
  - c. Structural Criteria:
    - 1) Suitable for all loads imposed including seismic loads.
    - 2) Outdoor panels: Suitable for all loads imposed by wind loads.
    - 3) Comply with the Florida Building Code.

4. Coatings:
  - a. Coat all FRP as specified in Contract Documents.
  - b. Color of all panels to be white.
5. Drainage:
  - a. Provide sample panels with drain troughs where indicated on the Drawings. Drain troughs connected to the panel shall run the entire length of the sample area to collect water from sample valves and channel it to the trench below the panel. The drain line shall be hardpiped to the nearest floor drain in the trench floor. The channel shall be sloped to a 2" drain at 1/8" vertical fall per foot of horizontal length center to prevent standing water in the channel. The channel outlet shall have a male threaded connection on the bottom of the channel to allow for connection to a 2-inch SCH 80 PVC pipe.
  - b. For pipe mounted instruments, provide an FRP trough underneath each row of instruments to catch air bleed water. Route drain piping as shown on the Drawings.
  - c. Route drain lines to the nearest trench floor drain or as shown on the Drawings. Minimize splashing of water into floor drains to reduce hydrogen sulfide release into the process buildings.
6. Labels:
  - a. Label all instruments and panels with plastic plates in accordance with Contract Documents.
7. Pumps:
  - a. Sample pumps to be as noted on the Drawings.
  - b. Mount pumps on sample panels as indicated in the Drawings.
8. Panel Instrumentation:
  - a. Panel instrumentation shall be as specified in Specification 40\_91\_00
9. Anchorage and Support
  - a. Sample panel supports shall reside on a 6-inch (minimum) equipment pad and be securely supported and anchored.
  - b. Anchorage:
    - 1) Anchors, bolts and washers shall be Type 316 stainless steel.
    - 2) Nuts shall be silicon bronze.
  - c. Installation: As indicated on the Drawings.
10. Pipeline and tubing
  - a. Panel sample tubing shall be in accordance with Section 40 90 00 and as shown on the drawings.
  - b. Valves shall be as specified in the Contract Documents unless otherwise noted on the Drawings.
  - c. Testing in accordance with Section 01\_75\_17.
  - d. Disinfection in accordance with the Contract Documents.
  - e. Mechanical equipment testing in accordance with Section 01\_75\_17

## **2.05 FIBER OPTIC DATA CABLE AND ACCESSORIES**

- A. Furnish fiber optic data cable for installation in the duct bank being furnished and installed under Division 16, ELECTRICAL. Fiber optic cable is required for data highway between the computers, PLCs as well as for remote I/O links as shown on the block diagram. The fiber optic cable shall be compatible with the PLCs, computers and data concentrators and provide error free data communication between specified devices at typical Ethernet data speeds. The fiber optic cable shall be a six-fiber outdoor type cable suitable for installation and pulling through a

duct bank. For simple point to point fiber optic link, the cable shall be six fiber 62.5/125 microns as manufactured by Belden Wire and Cable Company, Catalog No. 225716, or approved equal.

- B. Furnish compatible connectors and breakout kits with the cable. Furnish enough connectors and breakout kits to meet the project requirements and install connectors on all fiber optic cable. Coordinate length requirements with the Electrical CONTRACTOR. Use Contract Drawings as a guide in determining lengths, take into account actual field conditions. Get a written approval from the PLC System Manufacturer before ordering the cable. Use the fiber optic connectors, termination kits, and cable test kits per cable manufacturer, compatible with specified data concentrators, and PLC supplier's recommendation. I&C Subcontractor shall be responsible for proper selection of fiber optic cables. Coordinate with Division 16, ELECTRICAL.
- C. All Fiber Optic Cable shall terminate in fiber optic patch panels. Provide Fiber Optic jumpers as required for equipment

### **PART 3 EXECUTION**

CONTRACTOR shall refer to the specification section 01\_11\_00 Summary Of Work for detail sequence of construction and schedule and coordinate his/her work accordingly.

#### **3.01 GENERAL INSTALLATION**

- A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the ENGINEER during construction. Obtain in the field all information relevant to the placing of process control work and in case of any interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner. All instruments shall be mounted as to allow access for service without the use of portable ladders.
- B. The instrumentation loop diagrams indicate the intent of the interconnection between the individual instruments. Any exceptions should be noted. Two complete sets of approved shop drawings shall be kept at the job site during all on-site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or start-up. All markings shall be verified and initialed by the ENGINEER or his/her designated representative.
  - 1. Following completion of installation and the operational readiness test, one set of the marked up drawings shall be provided to the ENGINEER, the other retained by the supplier for incorporation of the mark-ups into final as-built documentation.
- C. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the American Petroleum Institute (API) Recommended Practice 550 shall be followed as applicable.

- D. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CONTRACTOR shall bear full responsibility for such violations and assume all costs arising therefrom.
- E. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required on the Electrical Drawings for the locations. All work shall be in strict accordance with codes and local rulings, should any work be performed contrary to said rulings, ordinances and regulations, the supplier shall bear full responsibility for such violations and assume all costs arising there from.
- F. Unless specifically shown in the Drawings, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands as detailed on the installation detail drawings. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, valve manifolds for calibration, testing and blowdown service shall also be provided. For slurries, chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.
- G. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors and shut-off valves.
- H. Field instruments requiring power supplies shall be provided with local electrical shutoffs and fuses as required.
- I. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.
- J. The system supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the system supplier shall be required to ship his/her material in sections sized to permit passing through restricted areas in the building. The system supplier shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel to assure proper space and access (front, rear, side).
- K. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground point be employed for each shield.
- L. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.
- M. The system supplier, acting through the CONTRACTOR, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the ENGINEER's approval. He/She shall be responsible to insure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to insure a satisfactory functioning installation. The CONTRACTOR hereunder shall schedule and coordinate his/her work under this section with that of the electrical work specified under applicable Sections of Division 16.

- N. Fiber Optic Cable Installation and Termination:
- O. Fiber optic cable shall be furnished by the I&C CONTRACTOR and installed under Division 16, ELECTRICAL, as specified. Provide the services of an experience fiber optic cable terminator and tester under this Contract (I&C). The I&C CONTRACTOR shall supervise the cable installation and shall carry out all terminations at the I/O racks, repeaters, and data concentrators at PLCs and computers. Fiber optic cable termination shall be carried out using the appropriate connectors and termination kit. All fiber optic system components shall be products of one manufacturer.
- P. Fiber optic cable system shall be designed to minimize cable splicing. Where splicing becomes necessary, perform fusion splice with loss not to exceed 0.2 dB. Test all splices with an Optical Time Domain Reflectometer (OTDR) bidirectionally to verify splice loss at the time of splicing. Redo any splices not conforming to these Specifications. Provide means to protect the unspliced portions of the cable from intrusion of moisture and other foreign mater. Identify required splices in the submittal. Splices not identified in the submittal shall be brought to the attention of the ENGINEER for approval.
- Q. After the fiber optic data link is in place, test attenuation from hub to hub bi-directionally and document test results. Attenuation shall not exceed 3.5 dB/km at 850 nm wave length and 1.0 dB/km at 1,300 nm.
- R. I&C Subcontractor is responsible for the satisfactory performance of all fiber optic data links. Demonstrate and document error free bidirectional data files transfer to each PLC node.

### **3.02 TESTS (GENERAL)**

- A. The supplier shall test all equipment at the factory prior to shipment. Unless otherwise specified in the individual specification sections, all equipment provided by the supplier shall be tested at the factory as a single fully integrated system.
- B. As a minimum, the testing shall include the following:
  - 1. Operational Readiness Tests (ORT).
  - 2. Functional Demonstration Tests (FDT).
  - 3. 30-Day Acceptance Tests
- C. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
- D. All tests shall be conducted in accordance with prior ENGINEER- approved procedures, forms and checklist. Each specific test to be performed shall be described and a space provided after it for signoff by the appropriate party after its satisfactory completion.
- E. Copies of these signoff test procedures, forms and checklists will constitute the required test documentation.
- F. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical

to test with real process variables, equipment and data, provide suitable means of simulation. Define these simulations techniques in the test procedures.

- G. The CONTRACTOR shall require the supplier to coordinate all of his/her testing with him, all affected Subcontractors and the OWNER.
- H. The ENGINEER reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved Test Procedures.
- I. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.
- J. No equipment shall be shipped until the ENGINEER has received all test results and approved the system is ready for shipment.
- K. The supplier shall furnish the services of servicemen, all special calibration and test equipment and labor to perform the field tests.

### **3.03 OPERATIONAL READINESS TESTS (ORT)**

- A. General: Prior to startup and the Functional Acceptance Test, the entire system shall be certified (inspected, tested and documented) that it is READY for operation.
- B. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and these Specifications.
  - 1. The Loop/Component Inspections and Tests shall be implemented using ENGINEER-approved forms and checklists.
    - a. Each loop shall have a Loop Status Report to organize and track its inspection, adjustment and calibration. These reports shall include the following information and checkoff items with spaces for signoff by the system supplier:
      - 1) Project Name.
      - 2) Loop Number.
      - 3) Tag Number for each component.
      - 4) Checkoffs/signoffs for each component.
        - a) Tag/identification
        - b) Installation
        - c) Termination - wiring
        - d) Termination – tubing
        - e) Calibration/adjustment
      - 5) Checkoffs/signoffs for the loop.
        - a) Panel interface terminations
        - b) I/O interface terminations
        - c) I/O signal operation
        - d) Inputs/outputs operational: received/sent, processed, adjusted
        - e) Total loop operation
      - 6) Space for comments.
    - b. Each active Analog Subsystem element and each I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry and a space for signoff by the system supplier:

- 1) Project Name.
  - 2) Loop Number.
  - 3) Component Tag Number of I/O Module Number.
  - 4) Component Code Number Analog System.
  - 5) Manufacturer (for Analog system element).
  - 6) Model Number/Serial Number (for Analog system).
  - 7) Summary of Functional Requirements. For example:
    - a) For Indicators and Recorders: Scale and chart ranges
    - b) For Transmitters/Converters: Scale and chart ranges
    - c) For Computing Elements: Function
    - d) For Controllers: Action (direct/reverse) control modes (PID)
    - e) For Switching Elements: Unit range, differential (FIXED/ADJUSTABLE), *reset (AUTO/MANUAL)*
    - f) For I/O Modules: Input or output
  - 8) Calibrations; for example:
    - a) For Analog Devices: Required and actual inputs and outputs at 0, 25, 50, 75 and 100 percent of span, rising and falling.
    - b) For Discrete Devices: Required and actual trip points and reset points.
    - c) For Controllers: Mode settings (PID). For I/O Modules: Required and actual inputs or outputs for 0, 25, 50, 75 and 100 percent of span, rising and falling.
      - (1) Space for comments.
      - (2) Space for signoff by the system supplier.
2. The CONTRACTOR shall require the system supplier to maintain the Loop Status Reports and Components Calibration sheets at the jobsite and make them available to the ENGINEER/OWNER at any time.
  3. These inspections and tests do not require witnessing. However, the ENGINEER will review and initial all Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Readiness Tests. Any deficiencies found shall be corrected.

### 3.04 FUNCTIONAL ACCEPTANCE TEST (FAT)

- A. Prior to startup and the Functional Acceptance Test, the entire installed instrument and control system shall be certified that it is ready for operation. All preliminary testing, inspection, and calibration shall be complete as defined in the operational readiness tests.
- B. Once the facility has been started up and is operating, a witnessed Functional Acceptance Test shall be performed on the complete system to demonstrate that it is operating and in compliance with these Specifications. Each specified function shall be demonstrated on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.
- C. Loop-specific and non-loop-specific tests shall be the same as specified under Factory Demonstration Tests except that the entire installed system shall be tested and all functions demonstrated.
- D. Updated versions of the documentation specified to be provided for during the Factory Tests shall be made available to the ENGINEER at the jobsite both before

and during the tests. In addition, one copy of all O & M Manuals shall be made available to the ENGINEER at the jobsite both before and during testing.

- E. The daily schedule specified to be followed during the Factory Tests shall also be followed during the Functional Acceptance Testing.
- F. The system shall operate for a continuous 100 hours without failure before this test will be considered successful.

### **3.05 30-DAY ACCEPTANCE TEST**

- A. After completion of the Functional Acceptance Test, the System Supplier shall be responsible for operation of the entire system for a period of 30 consecutive days, under conditions of full plant process operation, without a single non-field repairable malfunction.
- B. During this test, plant operating and supplier personnel shall be present as required. The original programmer shall provide the start up assistance, unless OWNER approve otherwise.
- C. While this test is proceeding, the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.
- D. Any malfunction during the tests shall be analyzed and corrections made by the system supplier. The ENGINEER and/or OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.
- E. Any malfunction, during this 30 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the Supplier's personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.
- F. Upon completion of repairs, by the system supplier, the test shall be repeated as specified herein.
- G. In the event of rejection of any part or function, perform repairs or replacement within 90 days.
- H. All data base errors must be corrected prior to the start of each test period. The 30 day test will not be considered successful until all data base points are correct.
- I. The total availability of the system shall be greater than 99.5 percent during this test period. Availability shall be defined as "Avail. = (Total Time-Down Time) ÷ Down Time". Down times due to power outages or other factors outside the normal protection devices or backup power supplies provided, shall not contribute to the availability test times above.
- J. Upon successful completion of the 30 day operation test and subsequent review and approval of complete system final documentation, the system shall be considered substantially complete and the one year warranty period shall commence.



### **3.06 TRAINING**

- A. Refer to specification 01\_75\_17 for training requirements.

### **3.07 WARRANTY/PREVENTIVE MAINTENANCE**

- A. A written maintenance contract executed by the supplier shall be provided to the OWNER for on-site warranty and preventive maintenance services. This maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 24 hours, to provide complete system maintenance for a period of one year after the date of final acceptance of the system.
- B. The maintenance contract shall also include a minimum of 12 (monthly) preventive maintenance visits by a qualified serviceman of the supplier who is familiar with the type of equipment and software provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning and lubrication of system equipment and verification of correct software operation.
- C. Emergency maintenance procedures or plant visits may coincide with a preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The supplier shall have full responsibility for the system hardware and software preventive and corrective maintenance.
- D. During the one-year maintenance period, observation of maintenance operations by OWNER's personnel and the instruction of said personnel in the details of the maintenance work being performed, shall be provided. At the end of the maintenance contract period, the Supplier shall replenish the spare parts supply to the original status of component parts and physical condition.
- E. The costs for the one-year warranty and preventive maintenance service contract shall be included in the Contract Price, but as a separate line item which may be deleted by the OWNER for a full credit anytime before final acceptance of the system.
- F. An annual fee shall be quoted within 90 days after final acceptance for the purpose of entering a contract for annual maintenance subsequent to the first year of maintenance. Standard per diem rates for providing breakdown service shall be set forth in the contract. Such rates shall be fair and reasonable and reflect the lowest rates offered to most favored customers. The fee quoted shall be firm for a minimum of 90 days from date of issue.
- G. During the one-year maintenance period, the original programmer of the PLC logic or person who has intimate knowledge of the software and approved by County shall respond within 24 hours by phone and 48 hours onsite to request for corrective actions. If programmer fails to respond within given time, the County will back charge the CONTRACTOR for taken actions.
- H. Refer to specification 01\_77\_00 for additional requirements.

### **3.08 CONTROL SYSTEM DIAGRAMS AND DETAILS**

- A. To assist the system supplier in determining the requirements included , a series of loop diagrams and details are provided. Unless specifically stated otherwise, the system supplier shall be responsible for providing all instrumentation, control equipment and auxiliary devices necessary to perform the functions specified herein and as shown and described on these diagrams. Any auxiliary devices such as lightning/surge protectors, relays, timers, signal isolators, signal boosters, etc, which are necessary for complete operation of the system, or to perform the functions specified shall be included, whether or not they are specifically shown or tabulated on the loop diagrams.
- B. The intent of the loop diagrams is to describe in as much detail as possible, the hardware, software and functional requirements of a process measurement or control system. They are not intended to convey requirements for conduit and wiring between panels or system components. This information is included in appropriate electrical specifications and Drawings.
- C. To assist the system supplier in determining the requirements included and intent of the contract documents, written control descriptions have been included at the end of this section. The control descriptions are general in nature and do not detail all auxiliary devices and interlocks required.

END OF SECTION



## SECTION 40\_90\_00A

### APPENDIX A PROCESS INSTRUMENTATION AND CONTROLS LOOP DESCRIPTIONS

Note: Use Loop descriptions as additional information, requirements and guidance to the Loop Diagrams drawings. Refer to Loop Diagrams Drawings to identify new equipment, existing equipment to be replaced, and existing equipment to remain.

#### **LOOP NO. 303 SULFURIC ACID DAY TANK LEVEL AND ISOLATION VALVE**

The new replacement level indicating transmitter shall reuse existing signals from replaced level indicating transmitter to continuously monitor the sulfuric acid day tank level. The transmitter sends a 4-20 mA analog signal from Sulfuric Acid LCP RIO through communication to the PLC. The level is indicated locally, and indicated, recorded, and stored at the SCADA System. The level is alarmed and recorded based on an operator selectable set points for high and low level at the SCADA System.

The new pneumatically operated quarter-turn Sulfuric Acid day tank isolation ball valve shall reuse existing signals from the replaced, pneumatically operated, quarter-turn ball valve. The day tank isolation valve position (open /closed) shall be monitored from the position switches supplied with the control valve, transmitted from the Sulfuric Acid LCP RIO through communication to the PLC, and will be used to provide position feedback to be displayed and recorded at the SCADA System. The valve output commands (open or close) will be provided by the PLC through communication via dry discrete outputs from Sulfuric Acid LCP

#### **LOOP NO. 31X (X-3,2) SULFURIC ACID FEED PUMP**

The existing sulfuric acid feed pumps shall be replaced with the new pumps of a larger capacity. New pumps shall reuse the same signals as the existing feed pumps. The sulfuric acid feed pumps are variable speed and are controlled by a local metering pump control panel (with VFDs) supplied by the metering pump supplier. The controller is located in the chemical feed room and utilizes Sulfuric Acid LCP RIO to send to the PLC the following system inputs:

- Controller running status dry contacts for system on/off to be displayed on the SCADA System and to activate an elapsed time meter to be totalized and recorded at the SCADA System for each pump.
- Controller in HOR status signal is to be displayed and recorded at the SCADA System.
- Pump speed input shall be transmitted via 4–20mA analog signal to be indicated at the SCADA System.

The pumps shall be locally monitored and operable for all functions at the controller located in the chemical room.

The Controller shall receive from the PLC the following system outputs:

- Pump start/stop control based on operator manual pump selection from the SCADA System or from the PLC automatic pump selection logic based on system permissives and plant operating status.
- Pump speed pacing output shall be via 4-20 mA analog signal output from PLC controller.

The existing PLC control program for sulfuric acid metering pumps shall be updated to provide sulfuric acid dosing based upon the number of RO trains running. The sulfuric acid metering pumps shall be pre-calibrated (i.e., stroke adjusted) to be able to deliver the following flow rates, by adjusting the metering pump output speed to a user adjustable set point, to deliver a 322 mg/L dose, that results in the following chemical flow rates (i.e., 4.9 gph sulfuric acid per RO train running):

- 1 RO train running; 93 percent sulfuric acid flow = 4.9 gph
- 2 RO trains running; 93 percent sulfuric acid flow = 9.8 gph
- 3 RO trains running; 93 percent sulfuric acid flow = 14.6 gph
- 4 RO trains running; 93 percent sulfuric acid flow = 19.5 gph

**LOOP NO. 312A SULFURIC ACID FEED ISOLATION VALVE TO BLENDED PERMEATE**

Remove the existing sulfuric acid isolation valve. Disconnect I/Os in the panel. Eliminate those points in the program.

**LOOP NO. 312B SULFURIC ACID FEED ISOLATION VALVE TO RO FEED**

Remove the existing sulfuric acid isolation valve. Disconnect I/Os in the panel. Eliminate those points in the program.

**LOOP NO. 313 SULFURIC ACID FEED ISOLATION VALVE TO SCAVENGER DISCHARGE PIPING**

Remove the existing sulfuric acid isolation valve. Disconnect I/Os in the panel. Eliminate those points in the program.

**LOOP NO. 312 SULFURIC ACID FLOW**

Remove the existing sulfuric acid mass flow meter. Disconnect I/Os in the panel. Eliminate those points in the program.

**LOOP NO. 312C SULFURIC ACID FEED ISOLATION VALVE TO MEMBRANE CONCENTRATE**

Sulfuric Acid feed isolation valve position (open /closed) shall be monitored from the position switches supplied with the control valve, transmitted from the Sulfuric Acid LCP RIO through communication to the PLC, and will be used to provide position feedback to be displayed and recorded at the SCADA System. The valve output commands (open or close) will be provided by the PLC through communication via dry discrete outputs from Sulfuric Acid LCP. Reuse available I/O points to interface new feed isolation valve to membrane concentrate.

END OF SECTION

## SECTION 40\_91\_00

### PROCESS INSTRUMENTATION AND CONTROLS - PRODUCTS

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. This section covers the furnishing, installation and modifications related to the following systems and subassemblies:
  - 1. Modification of the existing Sulfuric Acid Local Control Panel.
  - 2. Modify existing PLC logic and SCADA to accommodate work defined in the drawings and specifications.
  - 3. Removal of the Sulfuric Acid Mass Flow Meter.
  - 4. Replacement of the existing Day Tank Isolation Valve with new.
  - 5. Replacement of the existing Sulfuric Acid Feed Pumps Skid.
  - 6. Removal of the existing Sulfuric Acid Isolation Valves to injection points.
  - 7. Addition of the new Sulfuric Acid Isolation Valve to Membrane Concentrate.
  - 8. Replacement of the existing Sulfuric Acid day tank.
  - 9. Replacement of the existing Sulfuric Acid day tank level sensor/transmitter.
- B. Adjust all instrumentation signals accordingly and per drawings.

##### 1.02 RELATED REQUIREMENTS

- A. Refer to Section 40\_90\_00.

##### 1.03 SUBMITTALS

- A. Refer to Section 40\_90\_00.

##### 1.04 REFERENCE STANDARDS

- A. Refer to Section 40\_90\_00.
- B. All equipment shall be listed and labeled as defined in Article 100 of National Electrical Code, and shall satisfy applicable Federal, State and local codes.

##### 1.05 QUALITY ASSURANCE

- A. Refer to Section 40\_90\_00.

##### 1.06 MAINTENANCE AND TEST EQUIPMENT

- A. Refer to section 40\_90\_00.

## **PART 2 PRODUCTS**

### **2.01 FIELD MOUNTED INSTRUMENTS**

- A. Radar Type Level Transmitter
  - 1. Sensor
    - a. Manufacturers:
      - 1) Ohmart Vega, VegaPuls 61

### **2.02 PANEL MOUNTED INSTRUMENTS**

- A. Electronic Indicator
  - 1. Type:
    - a. Vertical bar graph type.
  - 2. Functional/Performance:
    - a. Accuracy - Plus or minus 0.5 percent.
    - b. Display - Dual or single display as required, multisegmented gas discharge tube.
    - c. Display Life - 10 years.
    - d. Input - 4-20 mA
    - e. Ambient Temperature Range - 0 to 50 degrees C
  - 3. Physical:
    - a. Mounting - Flush panel mounting, suitable for high density, slide tray rack mounting.
    - b. Dimensions - Approximately 3-in by 6-in by 20-in.
    - c. Scales - Shall be in engineering units.
  - 4. Options/Accessories Required:
    - a. Nameplates - Provide individual nameplates below each process input.
    - b. Scales - Scales shall be in engineering units.
  - 5. Manufacturers:
    - a. Fischer and Porter
    - b. Foxboro
    - c. Moore Products
    - d. Bailey Controls
- B. Digital Panel Meter
  - 1. Type:
    - a. Digital process meter.
  - 2. Functional/Performance:
    - a. Accuracy - 99.9 percent.
    - b. Power requirements - 120V AC or 24V DC as required.
    - c. Operating temperature - 0 to 60 degrees C
    - d. Display - LED display, 3-1/2 digit minimum resolution. The indicator shall indicate the value of the analog input signal in engineering units with scale range as noted. Decimal point shall be field selectable. Unit shall provide overrange indication.
  - 3. Physical:
    - a. Housing - High impact plastic with splashproof lens cover and gasketing to meet NEMA 4 requirements.
    - b. Legend - Provide a permanent service legend to display the engineering units of the process variable.
  - 4. Manufacturers:
    - a. Action Instruments
    - b. Newport Electronics
    - c. General Electric

C. Electronic Single Station Controller

1. Type:
  - a. Microprocessor based of the slide out chassis type.
2. Functional/Performance:
  - a. Measurement Accuracy - Plus or Minus 0.1 percent of span.
  - b. Output Signal Accuracy - Plus or Minus 0.2 percent of span.
  - c. Analog Inputs - 4-20 mA
  - d. Analog Outputs - 4-20 mA
  - e. Electrical Requirements - 120V AC or 24V DC as required.
  - f. Configurable Functions (Minimum):
    - 1) PID control (any mix)
    - 2) Ratio control
    - 3) Alarming
    - 4) Input signal conditioning (biasing, square root, etc)
    - 5) Anti-reset windup
    - 6) Cascade tracking
    - 7) Local/remote setpoint control
    - 8) Auto/manual output
    - 9) Choose local/remote or auto/manual control from remote location or locally at controller
    - 10) Output indication of local/remote and auto/manual, switch status
    - 11) Output rate limiting
    - 12) Direct or reverse control action
  - g. Ambient Temperature Limits - Plus 40 degrees F to plus 125 degrees F
  - h. Contact Inputs - 4 minimum.
  - i. Analog Inputs - 2 minimum.
  - j. Discrete Outputs - 2 minimum (switch position).
  - k. Alarm Contact Outputs - 4 minimum.
  - l. RFI Protection - Provide RFI protection.
  - m. Balanceless/Bumpless transfer between control modes.
  - n. Displays - 2 lines of 9 alpha numeric characters each for display of loop tags, configuration, inputs, setpoint, measurement and prompts. There shall also be 3 bright bar arrays for setpoint, process measurement and output.
3. Physical:
  - a. Dimensions - Approximately 3-in by 6-in by 20-in deep.
  - b. Panel Mount - Shall come with a slide out chassis which allows the controller to be withdrawn for service without disrupting operation.
4. Manufacturers:
  - a. Moore Products Co.
  - b. Fischer & Porter
  - c. Foxboro
  - d. Bailey Controls

**2.03 MISCELLANEOUS PANEL COMPONENTS**

A. Pilot Type Indicating Lights

1. Type:
  - a. Heavy duty oiltight type which utilizes a low voltage lamp.
2. Functional/Performance:
  - a. Units shall be provided with low voltage lamps suitable for the voltage supplied. Lights supplied with 120V AC power shall have integral reduced voltage transformers.
  - b. Lamps shall be replaceable from the front of the unit.
3. Physical:



- a. Lens color shall be as indicated on the instrument device schedule. Lens shall be approximately 1-1/4-in in diameter.
  - b. Provide legend faceplates engraved to indicate the required function of each device.
  - c. Units shall be rated NEMA 13 for indoor panels. Units located outdoors or indicated to be weatherproof shall be rated NEMA 4X.
4. Manufacturers:
- a. Microswitch
  - b. Allen Bradley
  - c. General Electric
- B. Rotary Hand Switches and Pushbuttons
- 1. Type:
    - a. Control devices shall be heavy duty oiltight type with stackable contact blocks.
  - 2. Functional/Performance:
    - a. Provide contact arrangement and switching action as required for the control system specified.
  - 3. Physical:
    - a. For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC service provide silver sliding contacts rated 5 amps at 125V DC, for electronic (millivolt/ milliamp) switching provide contacts rated lamp at 28V DC.
    - b. Pushbuttons shall have flush type operators. Selector switches shall have knob or wing lever operators.
    - c. Units shall be rated NEMA Type 13 for indoor service. Units located outdoors or indicated to be weatherproof shall be rated NEMA 4X.
    - d. Provide legend plates denoting switch/pushbutton position/ function.
  - 4. Options/Accessories Required:
    - a. Provide lock-out-pushbuttons, key-operators, etc, as indicated on the instrument device schedule.
    - b. Provide make-before-break bridging contacts where required.
  - 5. Manufacturers:
    - a. Microswitch
    - b. Allen Bradley
    - c. General Electric
- C. Square Type Selector Switches and Multilight Indicators
- 1. Type:
    - a. Selector switches and indicators shall be of the illuminated, multiple lamp, oiltight type with square shape display windows and removable contact blocks.
  - 2. Functional/Performance:
    - a. Provide contact arrangement as required for the control system specified.
  - 3. Physical:
    - a. For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC circuits provide silver sliding contacts rated 5 amps at 125V DC, for electronic (Millivolt/ Milliamp) switching duty provide gold plated sliding contacts rated lamp at 28V DC.
    - b. Units shall be approximately 2-1/2-in square and shall be divided into as many as four separate lightable quadrants.

- c. Indicating lights used with 120 volt control power shall be provided with an integral transformer to reduce the voltage.
  - d. Provide legend plates, color inserts and cover plates to indicate the required function.
4. Manufacturers:
- a. Microswitch type CMC

D. Potentiometers

- 1. Type:
  - a. Potentiometers shall be of the heavy duty type.
- 2. Functional/Performance:
  - a. Potentiometers shall be of the three wire type with a total resistance of 1000 ohms. Units shall be rated 2 watts. Linearity shall be plus or minus 5 percent.
- 3. Physical:
  - a. Units shall be rated NEMA 13 or NEMA 4 for indoor panels. Units used on outdoor panels or indicated as weatherproof shall be rated NEMA 4X.
  - b. Provide a legend plate with resolution of one percent of entire span of potentiometer.
- 4. Manufacturers:
  - a. Allen Bradley
  - b. Micro Switch
  - c. General Electric

E. Industrial Relays and Time Delays

- 1. Type:
  - a. Industrial heavy duty relays.
- 2. Functional/Performance:
  - a. Contact arrangement/function shall be as required to meet the specified control function specified.
  - b. Contacts shall be rated 10 amps continuous at 600 volts.
  - c. Relays shall be provided with convertible contact blocks.
  - d. Pneumatic time delay relays shall be used on time delays less than 180 seconds and shall be adjustable.
  - e. Solid state time delay relays shall be used on time delays between 180 seconds and one-hour.
- 3. Options/Accessories Required:
  - a. Provide all mounting rails, etc, that are required.
- 4. Manufacturers:
  - a. Square D
  - b. Allen Bradley

F. General Purpose Relays and Time Delays

- 1. Type:
  - a. Units shall be of the general purpose plug-in type.
- 2. Functional/Performance:
  - a. Coil voltage shall match supply voltage.
  - b. Contact arrangement/function shall be as required to meet the specified control function.
  - c. Mechanical life expectancy shall be in excess of 10 million.
  - d. Duty cycle shall be rated for continuous operation.

- e. Units shall be provided with integral indicating light to indicate if relay is energized.
  - f. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.
  - g. Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.
3. Physical:
    - a. For 120V AC service provide contacts rated 10 amps at 120V AC, for 24V DC service provide contacts rated 5 amps at 28V DC, for electronic (milliamp/millivolt) switching applicator provide gold plated contacts rated for electronic service.
    - b. Relays shall be provided with dust and moisture resistant covers.
  4. Options/Accessories Required:
    - a. Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.
    - b. Provide mounting rails/holders as required.
  5. Manufacturers:
    - a. Eagle signal controls
    - b. Allen Bradley
    - c. Potter & Brumfield
- G. Signal Relay Switches (Current Trips)
1. Type:
    - a. Solid state electronic type.
  2. Functional/Performance:
    - a. Input - 4-20 mA
    - b. Output - Isolated contact output, double pole double throw, rated 5 amps at 120V AC.
    - c. Accuracy - 0.1 percent.
    - d. Protection - Provide RFI protection.
    - e. Deadband - Adjustable between 0.1 and 5.0 percent of span.
    - f. Setpoint Adjustment - Provide graduated dial for each alarm set point from 0 to full scale. Alarms shall be adjustable to trip on rising or falling input signal.
    - g. Repeatability - Trip point repeatability shall be at least 0.1 percent of span.
  3. Physical:
    - a. Mounting - Suitable for mounting in an enclosure or high density instrument rack.
  4. Options/Accessories Required:
    - a. Mounting rack or general purpose enclosure as required.
  5. Manufacturers:
    - a. Rochester Instrument Systems
    - b. Acromag Inc.
    - c. Moore Industries
- H. Signal Isolators/Boosters/Converters
1. Type:
    - a. Solid state electronic type.
  2. Functional/Performance:
    - a. Accuracy - 0.15 percent.
    - b. Inputs - Current, voltage, frequency, temperature, or resistance as required.

- c. Outputs - Current or voltage as required.
  - d. Isolation - There shall be complete isolation between input Circuitry, output circuitry, and the power supply.
  - e. Adjustments - Zero and span adjustment shall be provided.
  - f. Protection - Provide RFI protection.
3. Physical:
    - a. Mounting - Suitable for mounting in an enclosure or instrument rack.
  4. Options/Accessories Required:
    - a. Mounting rack or general purpose enclosure as required.
  5. Manufacturers:
    - a. Rochester Instrument Systems
    - b. Acromag Inc.
    - c. Moore Industries

I. Signal Selectors, Computation, and Conditioning Relays

1. Type:
  - a. Solid state electronic type.
2. Functional/Performance:
  - a. Inputs - 4-20 mA
  - b. Outputs - 4-20 mA
  - c. Protection - Provide RFI protection.
  - d. Operation - The relay shall multiply, add, subtract, select, extract the square root, or perform the specified conditioning/computation function required. All inputs shall be able to be individually rescaled and biased as required.
  - e. Isolation - All inputs, outputs, and power supplies shall be completely isolated.
  - f. Accuracy - 0.35 percent of span.
  - g. Adjustments - Multiturn potentiometer for zero, span, scaling, and biasing.
3. Physical:
  - a. Mounting - Suitable for mounting in an enclosure or instrument rack.
4. Options/Accessories Required:
  - a. Mounting rack or general purpose enclosure as required.
5. Manufacturers:
  - a. Rochester Instrument Systems
  - b. Acromag Inc.
  - c. Moore Industries

J. Intrinsically Safe Relays

1. Type:
  - a. Relays shall be of the solid state electronic type in which the energy level of the sensing or actuation circuit is low enough to allow safe usage in hazardous areas.
2. Options/Accessories Required:
  - a. Relays shall match power supply provided.
  - b. Relays shall be located in non-hazardous areas.
3. Manufacturers:
  - a. Consolidated Electric
  - b. Gems Safe-Pak
  - c. Warrick Controls
  - d. R. Stahl, Inc.

## **2.04 ANALYTICAL INSTRUMENTS**

NOT USED.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. See execution requirements in Section 40 90 00.

END OF SECTION

## SECTION 43\_33\_20.01

### CHEMICAL PUMPS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Supply and testing of completely functional, skid-mounted chemical metering pump feed systems.
- B. Related Sections:
  - 1. Section 01\_60\_00 - Product Requirements.
  - 2. Section 01\_75\_17 - Testing, Training, and Facility Start-Up.
  - 3. Section 26\_20\_00 - Electrical Motors.
  - 4. Section 40\_05\_00.01 - Basic Piping Materials and Methods.
  - 5. Section 40\_05\_00.03 - Pipe Identification.
  - 6. Section 40\_05\_31.01 - Plastic Piping and Tubing.
  - 7. Section 40\_05\_63 - Ball Valves.
  - 8. Section 40\_05\_65.24 - Check Valves.

##### 1.02 SYSTEM DESCRIPTION

- A. Scope: Each individual chemical feed system shall include a skid assembly containing chemical metering pumps, motors, all necessary piping, valves, fittings, supports, electrical controls, and accessories (e.g., calibration columns, pulsation dampeners, etc.) as indicated in the Drawings and specified.
- B. SUPPLIER: The chemical metering pump manufacturer (SUPPLIER) shall be responsible for supplying all components of the skid-mounted chemical metering pump feed systems.
- C. Design Requirements:
  - 1. All chemical metering pumps and skid-mounted components shall be especially designed, adapted, and fully guaranteed for the respective, intended use and shall be constructed of materials compatible with the chemicals indicated in the service requirements.
  - 2. Chemical metering pumps are indicated as new in Article 2.02.
  - 3. The metering pump skid shall contain the following:
    - a. Polypropylene or polyethylene skid with drip lip.
    - b. Metering pumps.
    - c. Motors.
    - d. Calibration columns.
    - e. Pulsation dampeners.
    - f. Pressure gauges.
    - g. Ball valves and unions.
    - h. Pressure relief valves.
    - i. Diaphragm backpressure valves.

### **1.03 SUBMITTALS**

- A. Submit as specified in Contract Documents.
- B. Include evidence of compatibility with the chemicals indicated in the service requirements.

### **1.04 QUALITY ASSURANCE**

- A. As specified in Contract Documents.
- B. The existing sulfuric acid chemical metering pump skid shall be replaced with a new skid as specified. All new pumps and components shall be pre-assembled onto the skid-mounted system by the SUPPLIER and shop-tested for capacity and pressure prior to shipment. Documented results of testing shall be submitted to the ENGINEER.

### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. As specified in Contract Documents.

### **1.06 PROJECT CONDITIONS**

- A. Environmental Requirements: As specified in Contract Documents.

### **1.07 WARRANTIES**

- A. The chemical metering pump manufacturer shall provide a 2-year warranty on the metering pump mechanical drive of any new metering pumps and a 1-year warranty on the liquid end of such pumps, pump accessories, and the skid-mounted system.

### **1.08 MAINTENANCE**

- A. Special Tools: Deliver 1 set of any special tools needed to assemble and disassemble the metering pump.
- B. Extra Materials: Spare parts shall include a complete set of ball check valves (balls, seats, and gaskets) and a diaphragm for each pump.
- C. Supply spare parts and special tools as specified in Section 01\_60\_00.

## **PART 2 PRODUCTS**

### **2.01 NOT USED**

### **2.02 CHEMICAL METERING PUMPS**

- A. Manufacturers:
  - 1. ProMinent Fluid Controls, Inc.; model as scheduled.

- B. Sulfuric Acid Service: Suitable for service with 93.5 percent sulfuric acid at a temperature of 60 to 120 degrees F. Pump wetted materials shall be compatible with sulfuric acid. A new skid is required to accommodate the new metering pumps.
  - 1. Membrane Concentrate Sulfuric Acid Metering Pump:
    - a. Tag Number: 09-FD-01 (NEW)
    - b. Number of Pumps: 1.
    - c. Pump Capacity (each): 35.9 gallons per hour at 145 psi.
    - d. Type: Mechanically Actuated Metering Pump.
    - e. Model: Sigma/2 Control (16130 PVT).
  - 2. Membrane Concentrate Sulfuric Acid Metering Pump:
    - a. Tag Number: 09-FD-02 (NEW)
    - b. Number of Pumps: 1.
    - c. Pump Capacity (each): 35.9 gallons per hour at 145 psi.
    - d. Type: Mechanically Actuated Metering Pump.
    - e. Model: Sigma/2 Control (16130 PVT).

### **2.03 MECHANICALLY ACTUATED METERING PUMPS**

- A. The chemical metering pumps shall be a simplex, motor-driven, reciprocating, mechanically actuated diaphragm type. Hydraulically actuated metering pumps shall not be acceptable. The pump shall include integral motor, oil-lubricated or permanently grease lubricated bearings gear reducer and cam-and-spring drive mounted in an aluminum housing, such housing to be sealed into an outer plastic housing for corrosion protection with heat sink fins for cooling.
- B. All pumping functions shall be set by membrane-switch keypad and status shall be displayed on an illuminated LCD, which is readable at an offset angle of 45 degrees. Keypad will allow for simple scrolling and display of programmed parameters.
- C. The pump shall be fully tested to meet rated flow and pressure by the manufacturer.
- D. The power supply shall be 120 VAC, 60 Hz, 1 phase.
- E. The liquid end shall be physically separated from the drive unit by back plate with weep hole creating an air gap. An elastomer shaft wiper seal shall prevent contamination of the drive if the primary diaphragm fails. The liquid end shall also feature a secondary diaphragm separated from the primary diaphragm by a spacer plate with diaphragm-isolated pressure switch to close a contact for alarm annunciation diaphragm failure.
- F. The diaphragm shall be constructed of a steel core, vulcanized into nylon-reinforced EPDM, with PTFE-faced fluid contact surface. The diaphragm shall be of a convex design fitting into a concave liquid end to minimize dead volume and promote flow of solids in suspension.
- G. The liquid end shall be virgin PVDF. The suction and discharge valve shall be PVDF with PTFE faced Viton gasket seals and ceramic valve balls.
- H. Remote start/stop through a dry contact when in external control mode, via a remote dry contact shall be provided.
- I. Run feedback to the PLC via a remote dry contact shall be provided.



- J. Stroke length control shall be adjustable manually by means of a stroke length knob, in increments of 1 percent, from 0 percent to 100 percent of stroke length. The stroke length shall be displayed on the pump LCD in 1 percent increments.
- A. Stroke frequency control shall be done with an integral dual function VFD and stepper motor pump controller. The first 1/3 of the frequency in strokes per minutes will operate with the stepper motor and pump frequency greater than 1/3 will operate with the internal VFD. Control shall be switchable between manual or external control via external signal. In manual mode, stroke frequency control shall be manually adjusted by touch keypads, with the set stroke rate displayed on the pump's LCD. In external mode, stroke frequency shall be proportional to a 4-20 mA external signal.
- K. Programming:
  - 1. The pump shall be able to be calibrated to display pump output in gallons/hour or liters/hour. Calibration shall be maintained when stroke length is altered up to plus or minus 10 percent on the stroke length knob. If stroke length is altered by more than 10 percent, a yellow warning light will light and a flashing message "calib" will appear.
  - 2. The pump shall be equipped with the programmable function of electronic interlocking of the keypad by access code to prevent unauthorized adjustments to the pump.
  - 3. Keypad shall allow for scrolling and display on LCD such parameters as stroke frequency, stroke length, stroke counter, pump output in gals/hr or l/hr, dosing quantity, input signal being received by pump, and indication of external mode.
- L. Flow Assurance:
  - 1. Fault Indication: The metering pump shall have an integral relay to allow remote annunciation of a fault condition and an output corresponding to the flow output of the metering pump.

## **2.04 SKID-MOUNTED FEED SYSTEM**

- A. The skid-mounting of the metering pumps shall conform to the following requirements:
  - 1. Components to be mounted on the skid are as indicated on the Drawings and shall include the metering pump, calibration column, piping, valves, piping accessories (e.g., pulsation dampeners, back pressure valves, pressure relief valves, etc.), and wiring integral to the skid. The SUPPLIER shall be responsible for providing all equipment, valves and piping within the skid boundary.
  - 2. The skids shall be constructed of fusion welded polypropylene sheets with adequate supports for all equipment and piping and a 1/2-inch drip lip. Forklift truck cut outs shall also be provided.
  - 3. All new components of the skid-mounted system (pumps, piping and controls) shall be tested at the shop prior to shipping.
- B. Skid-mounted accessories to include the following:
  - 1. Calibration Column:
    - a. Provide one, clear plastic calibration column with vent for use in calibrating the metering pumps.

- b. Materials shall be compatible with the pumped liquid at the concentration specified.
  - c. The chamber shall be sized to give adequate capacity for a minimum 30-second draw down test at maximum pump capacity.
  - d. The scale shall give direct readings in both mL and gph without the need for calculations.
  - e. The top of the chamber shall have a threaded fitting to allow for piping to a vented drain system.
2. Pulsation Dampeners:
- a. Shall be of the single diaphragm design, capable of arresting water hammer in the pump discharge lines created by the metering pumps.
  - b. Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped at the concentration specified.
  - c. Provide one dampener on the discharge side of each metering pump.
  - d. Each pulsation dampener shall include an integral pressure gauge.
  - e. Pulsation dampeners shall be sized appropriately for each pump to remove a minimum of 95 percent of the pulsations. The SUPPLIER shall provide calculations to verify sizing.
  - f. Dampeners shall be provided with a true-union ball valve for shutoff.
3. Backpressure and Pressure Relief Valves:
- a. Backpressure Valves: Adjustable diaphragm backpressure sustaining type valve installed on pump discharge header and factory adjusted to pressure recommended by manufacturer. Materials to be suitable for rated chemical service.
  - b. Pressure Relief Valves: Adjustable diaphragm pressure relief valve installed externally on pump discharge header and factory adjusted to pressure recommended by manufacturer. Materials to be suitable for rated chemical service.
4. Pressure Gauge and Diaphragm Isolators: Provide a pressure gauge and diaphragm type chemical isolation suitable for each chemical service. Range of pressure gauge as indicated on the Drawings.
5. Sight Glass: Provide a clear sight glass with visual flow indicator on the pressure relief discharge. Materials to be suitable for each chemical service.
6. Safety Enclosure: Furnish each skid with a protective safety enclosure.
- a. Corner angles constructed of PVC stock or equal.
  - b. Side and top panels constructed of clear, shatter-resistant plastic sheets suitable for respective chemical service. Panels to be independently removable.
  - c. Furnish safety enclosure doors with piano hinges where indicated on the Drawings. Hinges, door latches, and fasteners shall be stainless steel of a grade suitable for specified chemical services.
7. Power and Control I/O Termination Box
- a. Each metering pump skid shall be furnished with an on-skid termination box pre-wired for connections to 120 V power and connections to control I/O for each pump mounted to skid.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Installation shall be as indicated on the Drawings and as required by the written instructions of the SUPPLIER.
- B. A factory trained field representative shall supervise the start-up, adjustment, and testing of the units.

### **3.02 DEMONSTRATION**

- A. Manufacturers Representative:
  - 1. The field representative shall provide training as specified in Section 01\_75\_17.
  - 2. The training time shall not be included in the start-up, adjusting and testing time.
- B. Manufacturers Field Services:
  - 1. The SUPPLIER shall inspect the system before initial startup and certify that the system has been correctly installed and prepared for startup as specified in the Contract Documents.

END OF SECTION

## SECTION 43\_33\_21

### CHEMICAL FEEDING EQUIPMENT, GENERAL

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS

- A. The Contractor shall furnish and install chemical feeding equipment, complete and operable, in accordance with the Contract Documents.
  - 1. Chemical feed pumps and related equipment shall be procured from a single manufacturer.
  - 2. The Contractor shall furnish and install piping and accessories to and from connection point on the packaged chemical feed system as shown on the Drawings.
- B. Equipment shall be from manufacturers with a minimum of 10 years of experience in the manufacture and assembly of similar products, with a record of successful installations. Such manufacturers shall maintain a well-established, authorized, local service agency with sufficient spare parts and personnel to respond within 48 hours to any service calls.
- C. Unless indicated otherwise, the requirements of this Section apply to all chemical feeding equipment in the Contract Documents.

##### 1.02 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01\_33\_00.
- B. Shop Drawings: Complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering materials used, power drive assemblies, parts, devices, pumps, tanks, mixers, supports, panels, and other accessories forming a part of the equipment, plus schematics, diagrams, and panel layouts.
- C. Certification: The Contractor shall obtain written certification from each manufacturer, addressed to the OWNER, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with these Specifications and the Drawings, and that the materials are best suited for the chemicals handled.
- D. Technical Manuals: Furnish complete operations and maintenance manuals prior to start-up.
- E. Spare Parts List: The Contractor shall obtain from the manufacturer a list of suggested spare parts for each piece of equipment subject to wear, such as seals, packing, gaskets, nuts, bolts, washers, wear rings, etc.
- F. Maintenance: Printed instructions relating to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and

diagram where necessary, shall be furnished in duplicate with each unit or set of identical units.

- G. Field Procedures: Instructions for field procedures for erection, adjustments, inspection, and testing shall be furnished prior to installation of the equipment.
- H. Calibration Graphs: The manufacturer's representative shall prepare a calibration graph from field tests for each chemical feed unit which does not have a rate set device. Graphs shall read in pounds per hour for dry feeders or in gallons per hour for liquid feeders. The graph shall show the rate setter graduation conversion to pounds per hour or gallons per hour throughout the range of the feed unit. Each graph shall be furnished on hard paper and be sealed in clear plastic.

### **1.03 MANUFACTURER'S SERVICE REPRESENTATIVE**

- A. Erection and Startup Assistance: Service and instruction assistance by the manufacturer's engineering representative for each equipment unit shall be furnished by the Contractor during the following period:
  - 1. One day during erection, unless indicated otherwise in Contract Documents.
  - 2. One day during startup, unless indicated otherwise in Contract Documents.
- B. Instruction of OWNER's Personnel: The Contractor shall furnish the services of a factory service representative to instruct the OWNER's personnel in the operation and maintenance of the equipment. This service shall consist of a minimum one day's visit to the plant.

### **1.04 GUARANTEES, WARRANTIES**

- A. After completion, the Contractor shall furnish to the OWNER the manufacturer's written guarantees that the equipment will operate with the published efficiencies, heads, criteria, and flow ranges and meet these specifications. The Contractor shall also furnish the manufacturer's warranties as published in its literature.

## **PART 2 – PRODUCTS**

### **2.01 GENERAL**

- A. Wherever it is required that a single manufacturer shall be responsible for the compatible and successful operation of the various components of any equipment unit, it shall be understood to mean that the Contractor shall provide only such equipment as the designated manufacturer will certify is suitable for use with its equipment and with the further understanding that this in no way constitutes a waiver of any indicated requirements.
- B. Manufactured items provided under this Section shall be new, of current manufacture, and shall be the products of reputable manufacturers specializing in the manufacture of such products.
- C. Where 2 or more units of the same type or size of equipment are required, such units shall be produced by the same manufacturer.

## 2.02 MATERIALS

- A. General: Materials employed in the equipment shall be suitable for the intended application; materials not specifically called for shall be high-grade, standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. The following table lists the chemicals used for this project and some of the suitable materials for the construction of chemical feeding equipment. Unless the manufacturer proposes more suitable materials, the table shall be adhered to:

Chemical	Solution Strength (%)	Primary Piping Materials	Ancillary Equipment Materials	Elastomeric Seals
Sulfuric Acid (SA) (H <sub>2</sub> SO <sub>4</sub> )	93.5	CPVC (Sch 80)	Halar Hastelloy C PE PVDF Ryton (PTFE) Teflon Type 316 stainless steel	Viton

## 2.03 APPURTENANCES

- A. **Nameplate:** Each piece of equipment shall be provided with a nameplate (of material compatible with chemical), indicating equipment characteristics, capacity, motor horsepower, speed, electrical characteristics, manufacturer, model number, serial number, etc.
- B. **Pressure Gauges:** Where indicated on Contract Drawings, chemical transfer and metering pumps and other equipment shall be equipped with pressure gauges with diaphragm seals in accordance with Contract Documents, except that the size of gauges on small metering pumps may be smaller than indicated in that section.
- C. **Calibration Columns:** Provide Calibration Columns as indicated on the Contract Drawings. Each Calibration Column shall be an acrylic tube with PVC heads. The columns shall be calibrated for 30-second sampling periods and shall have the capacity as indicated in the table below, and shall have a maximum height of 30 inches. Each column shall be securely supported at both top and bottom.

Calibration Column Chemical Service	Capacity (Liters)
Sulfuric Acid	2

- D. **Flow Sight Glass:** Provide sight flow sight glass as indicated on the Contract Drawings. Each sight flow indicator shall be constructed of the material specified below with 150 # rated flanges. The indicator shall be a flutter type. The flow sight glass shall be manufactured by Jacoby Tarbox style 910-FA-FLTR or equal.

Flow Sight Chemical Service	Body Material	Window Material
Sulfuric Acid	CPVC	Borosilicate

E. Pulsation Dampeners:

1. Manufacturers: One of the following or equal.
  - a. Prominent.
  - b. PULSAfeeder.
  - c. Wallace and Tiernan.
2. Pulsation dampeners shall be furnished by the chemical feed system manufacturer and installed on the chemical metering pump discharge lines as indicated on the Drawings.
3. The dampeners shall be gas or air charged, double diaphragm type complete with gas/air charge valve connection and pressure gauge graduated from 0 to 160 pounds per square inch.
4. The pulsation dampeners shall have Hypalon diaphragms, ductile iron chamber (exceptions listed in this paragraph), and allow no more than 6 percent discharge pressure fluctuation.
  - a. Sulfuric acid chamber material: CPVC
5. The dampeners shall have intermediate chamber constructed of PVC, located between the two diaphragms, so that no chemicals contact the outer ductile iron chamber sections.

F. Pressure Relief Valves:

1. Manufacturers: One of the following or equal
  - a. Prominent.
  - b. PULSAfeeder.
  - c. Wallace and Tiernan.
2. Relief valves shall be furnished and installed on the chemical metering pump discharge lines by the chemical feeder system manufacturer. As indicated on the Drawings.
3. Valve shall be set at a pressure no greater than 10 pounds per square inch above system pressure when metering pumps are at full capacity, pulsating flow.
4. Materials, wetted and non-wetted, shall be consistent with the table of compatible materials in paragraph 2.02 of this section.
5. Valve shall be externally adjustable and serviceable without removing from the pump discharge piping.

G. Diaphragm Backpressure Valves:

1. Manufacturers: One of the following or equal:
  - a. Prominent.
  - b. PULSAfeeder.
  - c. Wallace and Tiernan.
2. Valves shall be furnished by chemical metering pump manufacturer and installed as indicated on the Drawings.
3. The valves shall have a TFE diaphragm, body and seat material to match piping, PVC bonnet, and adjustable spring range of 15-50 pounds per square inch.
4. Valves shall produce a backpressure no greater than 10 pounds per square inch above valve set pressure when metering pumps operate a full capacity, pulsating flow.

- H. **Ball Valves Plastic Body:** As specified in Section 40\_05\_63.
- I. **Chemical Tank Discharge Connection Expansion Joints:** Provide a custom flexible connection for each chemical tank discharge connection as shown on the contract drawings. The flexible connection shall be manufactured by Harrington Plastics or equal. The flexible connection shall consist of all nonmetallic materials: polypropylene braided overwrap, convoluted PTFE liner, and PVDF flanges. The flexible connection shall be a minimum length of 6-inches and shall allow for minimum horizontal and vertical deflection of 1-inch.
- J. **Equipment Supports:** Chemical feeding equipment and piping shall be firmly supported on concrete equipment pads and anchored down.
- K. **Variable Speed Drives:** Variable speed drives, drive motors, speed control equipment, and accessories shall be furnished in accordance with Section 26\_29\_23 - Variable Frequency Drive Units.
- L. **Controls:** Controls shall be housed in enclosures with NEMA ratings, which comply with the area designations of the Contract Documents.
- M. **PVC Safety Shield (PVC Strips):** Contractor shall provide and install 8-inch PVC safety strips and mounting hardware to accompany each installed chemical metering pump skid. The strips shall be installed with a minimum of 50 percent overlap. Install the strips to a minimum height of 8 feet off the floor. The strips shall be constructed of PVC vinyl. Manufacturer shall be Kingman, Aleco, or equal.
- N. **Safety Equipment:** Where required by Code, chemical unloading, storage, and feeding equipment shall be provided with the necessary safety devices and warning signs, clearly visible.

## 2.04 TOOLS AND SPARE PARTS

- A. **Tools:** Special tools necessary for maintenance and repair of the equipment and one pressure grease gun for each type of grease required for the equipment shall be furnished as a part of the WORK; such tools shall be suitably stored in metal tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.
- B. **Spare Parts:** Furnish spare seals, packing, gaskets, wear rings, and bearings as required by the feed equipment sections.

## PART 3 –EXECUTION

### 3.01 INSTALLATION

- A. **General:** Chemical feeding equipment shall be installed in accordance with governing safety standards, the Shop Drawings, and as indicated.
- B. **Alignment:** Equipment shall be field tested to verify proper alignment, operation as indicated, and freedom from binding, scraping, vibration, shaft runout, leaks, or other defects. Drive shafts shall be measured just prior to assembly to ensure



correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

- C. Lubricants: The WORK shall include furnishing the necessary oil and grease for initial lubrication and testing of all equipment.

- END OF SECTION-

## SECTION 43\_41\_43

### POLYETHYLENE STORAGE TANKS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Polyethylene storage tanks.
- B. Related Sections:
  - 1. Section 01\_60\_00 - Product Requirements.
  - 2. Section 40\_05\_00.01 - Basic Piping Materials and Methods.
  - 3. Section 40\_05\_00.03 - Pipe Identification.
  - 4. Section 40\_05\_31.01 - Plastic Piping and Tubing.
  - 5. Section 40\_05\_63 - Ball Valves.

##### 1.02 REFERENCES

- A. American Society for Mechanical Engineers (ASME):
  - 1. B16.4 - Gray Iron Threaded Fittings.
  - 2. B16.5 - Pipe Flanges and Flanged Fittings.
- B. American Society for Testing and Materials (ASTM):
  - 1. D 638 - Standard Test Method for Tensile Properties of Plastics.
  - 2. D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - 3. D 1525 - Standard Test Method for Vicat Softening Temperature of Plastics.
  - 4. D 1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
  - 5. D 1998 - Standard Specification for Polyethylene Upright Storage Tanks.
  - 6. D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
  - 7. D 4883 - Standard Test Method for Density of Polyethylene by the Ultrasound Technique.
- C. National Fire Protection Association (NFPA):
  - 1. 30 - Flammable and Combustible Liquid Code.
- D. National Electrical Manufacturer's Association (NEMA).
- E. Occupational Safety and Health Administration (OSHA):
  - 1. 29 CFR Part 1910 - Occupational Safety and Health Standards.

##### 1.03 DESIGN CRITERIA

- A. Sulfuric Acid Day Tank:
  - 1. Number: 09-T-03.
  - 2. Rated Volume: 175 gallons.
  - 3. Diameter: Match existing.

4. Configuration: Vertical, flat bottom.
  5. Chemical Service: Sulfuric Acid (93.5% Solution).
  6. Height: Match existing.
  7. Specific Gravity: 1.84.
  8. Restraint System:
    - a. Lateral Restraint System:
      - 1) Provide lateral restraint system for securing tank to concrete pad inside enclosed building.
  9. Tank materials shall be suitable for use with chemical service specified. At a minimum, materials shall comply with the following:
    - a. Resin: HDLPE
    - b. Fitting Material: CPVC
    - c. Gasket Material: Viton
    - d. Bolt Material: Hastelloy C
- B. Tank Shell Thickness:
- a. Where applicable, in accordance with ASTM D 1998, Section 6.1.
  - b. Design tank wall thickness for liquid with specific gravity as specified.
  - c. Provide adequate thickness at all fittings and connection points for mounting of fittings to the tank without damage to the tank or causing excessive deflection.
  - d. Maximum allowable hoop stress used in tank wall thickness calculations per ASTM D 1998 shall be based on test data per ASTM D 2837.

#### **1.04 SUBMITTALS**

- A. Fabrication Drawings for Each Tank Including:
1. Dimensions.
  2. Tank wall thickness.
  3. Materials of construction.
  4. Tank fittings.
  5. Tank appurtenances.
  6. Tank restraint system(s).
  7. Tank resin and hoop stress data.
- B. Chemical compatibility sheet to include:
1. Chemical to be stored.
  2. Percentage of chemical.
  3. Temperature of chemical.
- C. Engineering design calculations of restraint system signed by a civil or structural engineer registered in the state where the project is located.
- D. Installation instructions.
- E. Warranty.
- F. Certification to certify that each tank is suitable for the specified chemical service, including tank fittings and gasket material.
- G. Proof of qualification: Provide lists of 5 installation and contact information with same type of application and chemical used.

- H. Manufacturer's unloading procedure.
- I. Manufacturer's installation instructions
- J. Supporting documentation of Manufacturer's certification to NSF/ANSI Standard 61
  - 1. Drinking Water System Components for water treatment chemicals.
- K. Supporting information of ISO 9001 certification.
  - 1. Factory Test Report
  - 2. Material, specific gravity rating at 600 psi @ 100 degrees F. design hoop stress.
  - 3. Wall thickness verification.
  - 4. Visual inspection.
  - 5. Impact test.
  - 6. Hydrostatic test.

**1.05 WARRANTY**

- A. Manufacturer Warranty Against Defects:
  - 1. Tank: 3 years full warranty. Prorated warranties are not acceptable.

**1.06 QUALITY ASSURANCE**

- A. Qualification of Manufacturer: Manufacturer with experienced personnel, physical facilities, and management capacity sufficient to produce custom-made rotationally molded polyethylene tanks of the size, exposure and chemical services specified for minimum 5 years with satisfactory performance record.

**PART 2 PRODUCTS**

**2.01 SCOPE OF SUPPLIES**

- A. Provide all materials, labor, equipment, and hardware to provide all polyethylene storage tanks with specified fittings and accessories, and wind load restraint systems, anchor bolts, fasteners, and flanged flexible connectors for complete installation in the positions and orientations indicated on the Drawings.

**2.02 MANUFACTURERS**

- A. One of the Following:
  - 1. Tank 09-T-03:
    - a. Snyder Industries Incorporated. Tank must use a resin that is resistant to optical clarity degradation from sulfuric acid (e.g., Sulfuric Acid Resin #880046)
    - b. Or, equal.

Chemical	Concentration	Resin	Tank Design Specific Gravity	Fitting Material	Gasket Material	Bolt Material
Sulfuric Acid	93.5%	HDLPE #880046	1.9	CPVC	Viton	Hastelloy

## 2.03 TANK MATERIALS

- A. High density linear polyethylene (HDLPE) in accordance with ASTM D 1998.
- B. Resin: Virgin high density linear polyethylene (HDLPE).
  - 1. Manufacturers: One of the following or equal:
    - a. Sulfuric Acid Resin #880046.
  - 2. Resin shall be formulated to resist against optical clarity degradation from 93.5% sulfuric acid.
- C. Ultra Violet Stabilizer: Add 0.25 percent stabilizer, in the type and amount recommended by the resin manufacturer.
  - 1. All polyethylene resin material shall contain a minimum of a U.V. 15 stabilizer as compounded by the resin manufacturer.
  - 2. Pigments may be added, but shall not exceed 0.25% (dry blended) of the total weight.
- D. Free of holes, blisters, crazing, cracking, delamination, undispersed raw materials and any sign of contamination from foreign matter.
  - 1. The finished tank wall shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking, and delaminations that will impair the serviceability of the vessel.
  - 2. All cut edges where openings are cut into the tanks shall be trimmed smooth.
- E. Resin shall Meet or Exceed the Following Properties:

Property	ASTM Test	Nominal Value
Density (Resin)	D 4883	Between 0.941 and 0.948 grams per cubic centimeter
Environmental stress cracking resistance (ESCR)	D 1693	550 hours minimum
Ultimate tensile strength	D 638	3,000 pounds per square inch at 2 inch/minute
Flexural Modulus	D 790	130,000 pounds per square inch.
Elongation at break	D 638	greater than 1,000 percent at 2 inch/minute maximum
Vicat softening point	D 1525	235 degrees Fahrenheit minimum

- F. Restraint System:
  - 1. Metal Components, Include Anchor Bolts:
    - a. Sulfuric Acid Day Tank:
      - 1) Hastelloy C.
  - 2. Concrete anchors or flush shells shall not be used.

## 2.04 FITTINGS

- A. Coordinate fittings with existing day tank. New tank shall connect to existing lines.
- B. Terminate in Socket, Threaded, or Flanged Connections:
  - 1. Flanges: 150 pound ANSI/ASME B 16.5.

2. Threaded Connections: ANSI/ASME B 16.4.
- C. Fittings at Upper Tank Sidewall or Top: Compression threaded type, long shank, CPVC flanged fittings with deep cut threads (not injection molded thread) and with dual wide nuts. All threads to be American pipe thread cut.
- D. Fittings on Tank Top: Bosses molded into the tank. Fittings shall be vertical.
- E. Flanged Outlet Drain Fitting in the Lower Tank Sidewall: Located at the bottom knuckle of the tank to allow full drainage of tank contents.
- F. Tank Fittings and Appurtenances:
  1. Sulfuric Acid Day Tank (09-T-03)
    - a. One - minimum 2 inch flanged inlet nozzle entering the top of tank.
    - b. One - minimum 2 inch flange outlet nozzle, integrally-molded with tank wall. Outlet flange shall connect to 3/4 inch chemical metering pump suction line per drawings.
    - c. One - minimum 2 inch flange drain nozzle, integrally-molded with tank wall.
    - d. One - 2 inch flanged overflow nozzle, integrally-molded with tank wall.
    - e. One - 2 inch flanged roof nozzle for mounting of radar type level sensor, entering top of tank at a distance of one-half the tank radius from the tank wall.
    - f. One - 2 inch flanged roof vent.
    - g. One - 17 inch threaded lid on top of the tank. Lid shall be of same material as tank.

## **2.05 ACCESSORIES**

- A. Radar type level sensor/transmitter.
  1. Replace existing radar type level sensor/transmitter and install in new day tank.

## **2.06 TANK FABRICATION**

- A. Rotationally molded construction in accordance with contract documents and ASTM D 1998.
- B. Provide for Each Tank the Following Shop Finishing:
  1. Shipping Label Identifying:
    - a. Tank tag number.
    - b. Chemical service.
  2. Permanent Labels:
    - a. Identification label.
    - b. National Fire Protection Association label specifically coded for the tank contents in accordance with NFPA 30.
    - c. Affix label onto the tank wall to be clearly visible from outside the tank enclosure.

## **2.07 TESTING**

- A. Each tank shall be leak tested by the manufacturer prior to shipment by filling with clean water for a period of at least 4 hours with all fittings installed and blinded.

There shall be no measurable drop in liquid surface. Any leaks shall be noted and repaired and the tank shall be re-tested for an additional 4 hours minimum. Reason for leak and method of repair shall be recorded and submitted to the ENGINEER. Any defects or leaks which have not been adequately repaired will be cause for rejection of the tank.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. General:
  - 1. Transportation, handling, storage of the tanks, and installation shall be in accordance with the manufacturer's printed instructions.
  - 2. Repair any damage to tank components or the insulation due to transportation or installation.
  - 3. Install piping to tank with sufficient flexibility to allow tank movement of 1 inch in any direction without damage to piping.
  
- B. Wind Load Restraint System:
  - 1. Install wind restraint systems according to contract documents and manufacturer's instructions.
  
- C. Lateral Restraint System:
  - 1. Install lateral restraint systems according to contract documents and manufacturer's instructions.

#### **3.02 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service:
  - 1. Inspect the installed tanks for proper installation.
  - 2. Instruct OWNER's personnel on operations and maintenance of the tanks.

END OF SECTION

## REQUIRED FORMS

### INVITATION TO BID

These forms are required and should be submitted with all submissions. If it is determined that forms in this selection are not applicable to your company or solicitation they should be marked “N/A or Not Applicable” across the form in large letters and returned with your submission package. **Note:** If submitting via hard copy the original must be a manually signed original. Include additional copies, if specified, in the Solicitation documents.

#### **Form # Title/Description**

##### **1 Solicitation Response Form**

All signatures must be by a corporate authorized representative, witnessed, and corporate and/or notary seal (as applicable.) The corporate or mailing address must match the company information as it is listed on the Florida Department of State Division of Corporations. Attach a copy of the web-page(s) from <http://www.sunbiz.org> as certification of this required information. Sample attached for your reference.

Verify that all addenda and tax identification number have been provided.

##### **1a Bid/Proposal Form**

This form is used to provide itemization of project cost. A more detailed “schedule of values” may be requested by the County

##### **1b Business Relationship Disclosure Requirement** (as applicable)

Sections 112.313(3) and 112.313(7), FL §, prohibit certain business relationships on the part of public officers and employees, their spouses, and their children. If this **disclosure is applicable, request form “INTEREST IN COMPETITIVE BID FOR PUBLIC BUSINESS” (Required by 112.313(12)(b), FL § (1983))** to be completed and **returned with solicitation response. It is the Bidder’s responsibility to request form and disclose this relationship, failure to do so could result in being declared non-responsive.**

NOTICE: UNDER THE PROVISIONS OF FL § 112.317 (1983), A FAILURE TO MAKE ANY REQUIRED DISCLOSURE CONSTITUTES GROUNDS FOR AND MAY BE PUNISHED BY ONE OR MORE OF THE FOLLOWING: IMPEACHMENT, REMOVAL OR SUSPENSION FROM OFFICE OR EMPLOYMENT, DEMOTION, REDUCTION IN SALARY, REPRIMAND, OR A CIVIL PENALTY NOT TO EXCEED \$5,000.00.

##### **2 Affidavit Certification Immigration Laws**

Form is acknowledgement that the Bidder is in compliance in regard to Immigration Laws.

##### **3 Reference Survey**

Provide this form to a minimum of three references. This form will be turned in with the bid or proposal package.

1. **Section 1:** Bidder/Proposer to complete with reference respondent’s information prior to providing to them for their response. (This is **not** the Bidder/Proposer’s information.)
2. **Section 2:** Enter the name of the Bidder/Proposer; provide the project information that the reference respondent is to provide a response for.
3. The reference respondent should complete “**Section 3.**”
4. **Section 4:** The reference respondent to print and sign name
5. A **minimum of 3 reference responses** are requested to be returned with bid or proposal package.
6. Failure to obtain reference surveys may make your company non-responsive.



**4** *Negligence or Breach of Contract Disclosure Form*

The form may be used to disclose negligence or breach of contract litigation that your company may be a part of over the past ten years. You may need to duplicate this form to list all history. If the Bidder has more than 10 lawsuits, you may narrow them to litigation of the company or subsidiary submitting the solicitation response. Include, at a minimum, litigation for similar projects completed in the State of Florida. Final outcome should include in whose favor the litigation was settled and was a monetary amount awarded. The settlement amount may remain anonymous.

If you have **no litigation**, enter **“None”** in the first **“type of incident”** block of the form. Please do not write N/A on this form.

**5** *Affidavit Principal Place of Business*

Certifies Bidder’s location information. Local Vendor Preference and Location Point values are excluded when prohibited by grant or funding source. (In such cases form will be informational only.)

**6** *Sub-Contractor List* (as applicable)

To be completed and returned when sub-contractors are to be utilized and are known at the time of the submission.

**7** *Public Entity Crime Form*

Any person or affiliate as defined by statute who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid or a contract to provide any goods or services to the County; may not submit a bid on a contract with the County for the construction or repair of a public building or a public work; may not submit bids or leases of real property to the County; may not be awarded or perform works as a contractor, supplier, subcontractor, or consultant under a contract with the County, and may not transact business with the County in excess of \$25,000.00 for a period of 36 months from the date of being placed on the convicted vendor list.

**8** *Trench Safety* (Required)

Self explanatory.

**9** *Bid Bond* (Required)

Self explanatory

*Bid/Proposal Label* (Required)

Self explanatory. Please affix to the outside of the sealed submission documents.

*Include any licenses or certifications requested* (as applicable)

Local Business Tax Account (as applicable)

Bidder’s responsibility to insure the Solicitation Response is mailed or delivered in time to be received no later than the specified opening date and time. (If solicitation is not received prior to deadline it cannot be considered or accepted.)



LEE COUNTY PROCUREMENT MANAGEMENT
SOLICITATION RESPONSE FORM

Date Submitted: \_\_\_\_\_ Deadline Date: 4/18/2017

SOLICITATION IDENTIFICATION: B170199DLK

SOLICITATION NAME: North Lee County Water Treatment Plant RO Concentrate Acid Feed System

COMPANY NAME: \_\_\_\_\_

NAME & TITLE: (TYPED OR PRINTED) \_\_\_\_\_

BUSINESS ADDRESS: (PHYSICAL) \_\_\_\_\_

CORPORATE OR MAILING ADDRESS: \_\_\_\_\_

[ ] SAME AS PHYSICAL

ADDRESS MUST MATCH SUNBIZ.ORG

E-MAIL ADDRESS: \_\_\_\_\_

PHONE NUMBER: \_\_\_\_\_ FAX \_\_\_\_\_

NOTE REQUIREMENT: IT IS THE SOLE RESPONSIBILITY OF THE BIDDER/PROPOSER TO CHECK LEE COUNTY PROCUREMENT MANAGEMENT WEB SITE FOR ANY ADDENDA ISSUED FOR THIS PROJECT. THE COUNTY WILL POST ADDENDA TO THIS WEB PAGE, BUT WILL NOT NOTIFY.

By responding to this sealed solicitation, the Bidder/Proposer makes all representations required by the instructions and further warrants and represents that: Bidder/Proposer has examined copies of all the solicitation documents and of the following addenda:

No. \_\_\_\_\_ Dated: \_\_\_\_\_ No. \_\_\_\_\_ Dated: \_\_\_\_\_ No. \_\_\_\_\_ Dated: \_\_\_\_\_
No. \_\_\_\_\_ Dated: \_\_\_\_\_ No. \_\_\_\_\_ Dated: \_\_\_\_\_ No. \_\_\_\_\_ Dated: \_\_\_\_\_

Tax Payer Identification Number: \_\_\_\_\_

(1) Employer Identification Number -OR- (2) Social Security Number:

\*\* Lee County collects your social security number for tax reporting purposes only

Please submit a copy of your registration from the website www.sunbiz.org establishing your firm as authorized (including authorized representatives) to conduct business in the State of Florida, as provided by the Florida Department of State, Division of Corporations. (a sample is attached for your reference)

1 Collusion Statement: Lee County, Fort Myers, Florida the undersigned, as Bidder/Proposer, hereby declares that no person or other persons, other than the undersigned, are interested in this solicitation as Principal, and that this solicitation is submitted without collusion with others; and that we have carefully read and examined the specifications or scope of work, and with full knowledge of all conditions under which the services herein is contemplated must be furnished, hereby bid/propose and agree to furnish this service according to the requirements set out in the solicitation documents, specifications or scope of work for said service for the prices as listed on the county provided price sheet or (CCNA) agree to negotiate prices in good faith if a contract is awarded.

2 Scrutinized Companies Certification: Section 287.135, FL §, "Prohibition against contracting with scrutinized companies." Prohibits agencies from contracting with companies, for goods or services over \$1,000,000, that are on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, Scrutinized Companies that Boycott Israel List, have been engaged in a boycott of Israel, or been engaged in business operations in Cuba or Syria. The County reserves the right to review, on a case-by-case basis, and waive this stipulation if it is deemed to advantageous to the County.

As the person authorized to sign on behalf of Respondent, I hereby certify that the company identified above is in compliance with Section 287.135, FL §. I understand that submission of a false certification may subject company to contract termination, civil penalties, attorney's fees, and/or costs.

**Form#1 – Solicitation Form, Page 2**

**3 Business Relationship Disclosure Requirement:** Sections 112.313(3) and 112.313(7), FL §, prohibit certain business relationships on the part of public officers and employees, their spouses, and their children. See Part III, Chapter 112, FL §, and/or the brochure entitled "A Guide to the Sunshine Amendment and Code of Ethics for Public Officers, Candidates and Employees" for more details on these prohibitions. However, Section 112.313(12), FL § (1983), provides certain limited exemptions to the above-referenced prohibitions, including one where the business is awarded under a system of sealed, competitive bidding; the public official has exerted no influence on bid negotiations or specifications; and where disclosure is made, prior to or at the time of the submission of the bid, of the official's or his spouse's or child's interest and the nature of the intended business. The Commission on Ethics has promulgated this form for such disclosure, if and when applicable to a public officer or employee.

**If this disclosure is applicable request form "INTEREST IN COMPETITIVE BID FOR PUBLIC BUSINESS" (Required by 112.313(12)(b), FL § (1983)) to be completed and returned with solicitation response. It is the bidder/proposer's responsibility to disclose this relationship, failure to do so could result in being declared non-responsive.**

**Business Relationship Applicable (request form)**       **Business Relationship NOT Applicable**

**4** Disadvantaged Business Enterprise (DBE) bidder/proposer? If yes, please attach a current certificate. Yes      No

**ALL SUBMISSIONS MUST BE EXECUTED BY AN AUTHORIZED AUTHORITY OF THE BIDDER/PROPOSER. WITNESSED AND SEALED (AS APPLICABLE)**

\_\_\_\_\_  
Company Name (Name printed or typed)



\_\_\_\_\_  
Authorized Representative Name (printed or typed)

(Affix Corporate Seal, as applicable)

\_\_\_\_\_  
Authorized Representative's Title (printed or typed)

\_\_\_\_\_  
Witnessed/Attested by: (Witness/Secretary name and title printed or typed)

\_\_\_\_\_  
Authorized Representative's Signature

\_\_\_\_\_  
Witness/Secretary Signature

Any blank spaces on the form(s), qualifying notes or exceptions, counter offers, lack of required submittals, or signatures, on County's Form may result in the submission being declared non-responsive by the County.

**Detail by Entity Name**  
**Florida Profit Corporation**  
Bill's Widget Corporation

**Filing Information**  
Document Number 655555  
FEI/EIN Number 5111111111  
Date Filed 09/22/1980  
State FL  
Status ACTIVE  
Last Event AMENDED AND RESTATED ARTICLES  
Event Date Filed 07/25/2006  
Event Effective Date NONE

**Principal Address**  
555 N Main Street  
Your Town, USA 99999  
Changed 02/11/2012

**Mailing Address**  
555 N Main Street  
MYour Town, USA 99999  
Changed 02/11/2012

**Registered Agent Name & Address**  
My Registered Agent  
111 Registration Road  
Registration, USA99999  
Name Changed: 12/14/2006  
Address Changed: 12/14/2006

**Officer/Director Detail**  
**Name & Address**  
Title P  
President, First  
555 AVENUE  
Anytown, USA99999  
Title V  
President, Second  
555 AVENUE  
Anytown, USA99999

Sample Only



Lee County Procurement Management  
**BID/PROPOSAL FORM**

**Company Name:** \_\_\_\_\_

**Solicitation #** **B170199DLK**      **Solicitation Name** **North Lee County Water Treatment Plant RO Concentrate Acid Feed System**

Having carefully examined the “Terms and Conditions”, and the “Detailed Scope of Work”, all of which are contained herein, propose to furnish the following which meet these specifications.

This page serves as a header/placeholder only. Please refer to the Excel document provided with the solicitation for the complete Bid Schedule. The Excel Document contains formulas for convenience, however it is the Contractor’s responsibility to verify all pricing and calculations are CORRECT. Lee County is not responsible for errors in formulas or calculations contained within Excel document(s).

REMINDER: In the event there is a discrepancy between the total quoted amount or the extended amounts and the unit prices quoted, the unit prices will prevail and the corrected sum will be considered the quoted price.

The County will only accept bids submitted on bid forms provided by the County. Bids submitted on other forms, other than those provided by the County, will deem Bidder as non-responsive and ineligible for award.

\_\_\_\_\_  
\_\_\_\_\_

*Required form 1c Minimum Requirements Table* (form may be expanded or duplicated as needed)

**Bidder Name:**

**Relevant Projects:** Three (3) projects performed in the last five (5) years that included installation of chemical feed system(s) for water treatment in an operational water treatment facility

<b>Owner Name:</b> _____	<b>Summary of Project Scope:</b>          
<b>Project Name:</b> _____	
<b>Project Address:</b> _____ _____	
<b>Owner Representative:</b> _____	
<b>Telephone:</b> _____	
<b>Representative E-Mail:</b> _____	
<b>Project Cost:</b> \$ _____	
<b>Construction Schedule:</b> <b>Planned</b> _____ (calendar days) <b>Actual</b> _____ (calendar days)	
<b>Project Size:</b> <b>Sq. Ft.</b> _____	
<b>Type of Government Service Related Facility</b> _____	

<b>Owner Name:</b> _____	<b>Summary of Project Scope:</b>          
<b>Project Name:</b> _____	
<b>Project Address:</b> _____ _____	
<b>Owner Representative:</b> _____	
<b>Telephone:</b> _____	
<b>Representative E-Mail:</b> _____	
<b>Project Cost:</b> \$ _____	
<b>Construction Schedule:</b> <b>Planned</b> _____ (calendar days) <b>Actual</b> _____ (calendar days)	
<b>Project Size:</b> <b>Sq. Ft.</b> _____	
<b>Type of Government Service Related Facility</b> _____	

<b>Owner Name:</b> _____	<b>Summary of Project Scope:</b>          
<b>Project Name:</b> _____	
<b>Project Address:</b> _____ _____	
<b>Owner Representative:</b> _____	
<b>Telephone:</b> _____	
<b>Representative E-Mail:</b> _____	
<b>Project Cost:</b> \$ _____	
<b>Construction Schedule:</b> <b>Planned</b> _____ (calendar days) <b>Actual</b> _____ (calendar days)	
<b>Project Size:</b> <b>Sq. Ft.</b> _____	
<b>Type of Government Service Related Facility</b> _____	

**Bidder Name:**

Owner Name: \_\_\_\_\_

Project Name: \_\_\_\_\_

Project Address: \_\_\_\_\_

Owner Representative: \_\_\_\_\_

Telephone: \_\_\_\_\_

Representative E-Mail: \_\_\_\_\_

Project Cost: \$ \_\_\_\_\_

Construction Schedule: **Planned** \_\_\_\_\_ (calendar days)

**Actual** \_\_\_\_\_ (calendar days)

Project Size: **Sq. Ft.** \_\_\_\_\_

Type of Government Service Related Facility \_\_\_\_\_

**Summary of Project Scope:**

Owner Name: \_\_\_\_\_

Project Name: \_\_\_\_\_

Project Address: \_\_\_\_\_

Owner Representative: \_\_\_\_\_

Telephone: \_\_\_\_\_

Representative E-Mail: \_\_\_\_\_

Project Cost: \$ \_\_\_\_\_

Construction Schedule: **Planned** \_\_\_\_\_ (calendar days)

**Actual** \_\_\_\_\_ (calendar days)

Project Size: **Sq. Ft.** \_\_\_\_\_

Type of Government Service Related Facility \_\_\_\_\_

**Summary of Project Scope:**

**Project Team:**

	Site 1		Site 2	
	Name	Years Experience	Name	Years Experience
Project Manager (minimum 10 years)				
Project Superintendent (minimum 10 years)				



LEE COUNTY  
S O U T H W E S T F L O R I D A

**AFFIDAVIT CERTIFICATION IMMIGRATION LAWS**

SOLICITATION NO.: B170199DLK SOLICITATION NAME: North Lee County Water Treatment Plant RO Concentrate Acid Feed System

LEE COUNTY WILL NOT INTENTIONALLY AWARD COUNTY CONTRACTS TO ANY CONTRACTOR WHO KNOWINGLY EMPLOYS UNAUTHORIZED ALIEN WORKERS, CONSTITUTING A VIOLATION OF THE EMPLOYMENT PROVISIONS CONTAINED IN 8 U.S.C. SECTION 1324 a(e) {SECTION 274A(e) OF THE IMMIGRATION AND NATIONALITY ACT (“INA”).

LEE COUNTY MAY CONSIDER THE EMPLOYMENT BY ANY CONTRACTOR OF UNAUTHORIZED ALIENS A VIOLATION OF SECTION 274A(e) OF THE INA. **SUCH VIOLATION BY THE RECIPIENT OF THE EMPLOYMENT PROVISIONS CONTAINED IN SECTION 274A(e) OF THE INA SHALL BE GROUNDS FOR UNILATERAL CANCELLATION OF THE CONTRACT BY LEE COUNTY.**

BIDDER/PROPOSER ATTESTS THAT THEY ARE FULLY COMPLIANT WITH ALL APPLICABLE IMMIGRATION LAWS (SPECIFICALLY TO THE 1986 IMMIGRATION ACT AND SUBSEQUENT AMENDMENTS).

Company Name: \_\_\_\_\_

\_\_\_\_\_  
Signature Title Date

STATE OF \_\_\_\_\_  
COUNTY OF \_\_\_\_\_

The foregoing instrument was signed and acknowledged before me this \_\_\_\_\_ day of \_\_\_\_\_  
20\_\_\_\_, by \_\_\_\_\_ who has produced  
(Print or Type Name)  
\_\_\_\_\_ as identification.  
(Type of Identification and Number)

\_\_\_\_\_  
Notary Public Signature

\_\_\_\_\_  
Printed Name of Notary Public

\_\_\_\_\_  
Notary Commission Number/Expiration

The signee of this Affidavit guarantee, as evidenced by the sworn affidavit required herein, the truth and accuracy of this affidavit to interrogatories hereinafter made. **LEE COUNTY RESERVES THE RIGHT TO REQUEST SUPPORTING DOCUMENTATION, AS EVIDENCE OF SERVICES PROVIDED, AT ANY TIME.**





Lee County Procurement Management

**REFERENCE SURVEY**

Solicitation # B170199DLK

**North Lee County Water Treatment Plant RO Concentrate Acid Feed System**

Section 1	Reference Respondent Information	<b>Please return completed form to:</b>	
<b>FROM:</b>	_____	<b>Bidder/Proposer:</b>	
<b>COMPANY:</b>	_____	<b>Due Date: April 18, 2017</b>	
<b>PHONE #:</b>	_____	<b>Total # Pages: 1</b>	
<b>FAX #:</b>	_____	<b>Phone #:</b>	<b>Fax #:</b>
<b>EMAIL:</b>	_____	<b>Bidder/Proposer E-Mail:</b>	

Section 2	Enter Bidder/Proposer Information, as applicable Similar Performed Project (Bidder/Proposer to enter details of a project performed for above reference respondent)		
Bidder/Proposer Name:	_____		
Reference Project Name:	Project Address:	Project Cost:	
Summarize Scope:	_____		

**You as an individual or your company has been given as a reference on the project identified above. Please provide your responses in section 3 below.**

Section 3	Indicate: "Yes" or "No"
1. Did this company have the proper resources and personnel by which to get the job done?	
2. Were any problems encountered with the company's work performance?	
3. Were any change orders or contract amendments issued, other than owner initiated?	
4. Was the job completed on time?	
5. Was the job completed within budget?	
6. On a scale of one to ten, ten being best, how would you rate the overall work performance, considering professionalism; final product; personnel; resources. <span style="float: right;">Rate from 1 to 10. (10 being highest)</span>	
7. If the opportunity were to present itself, would you rehire this company?	
8. Please provide any additional comments pertinent to this company and the work performed for you:	

**Section 4**

Reference Name (Print Name) \_\_\_\_\_

**Please submit non-Lee County employees as references**

Reference Signature \_\_\_\_\_



**ALLEGED NEGLIGENCE OR BREACH OF CONTRACT  
DISCLOSURE FORM**

Please fill in the form below. Provide each incident in regard to alleged negligence or breach of contract that has occurred over the past 10 years.

Please complete in chronological order with the most recent incident on starting on page 1.

**Company Name:** \_\_\_\_\_

<b>Type of Incident</b> <i>Alleged Negligence or Breach of Contract</i>	<b>Incident Date And Date Filed</b>	<b>Plaintiff</b> <i>(Who took action against your company)</i>	<b>Case Number</b>	<b>Court</b> <i>County/State</i>	<b>Project</b>	<b>Claim Reason</b> <i>(initial circumstances)</i>	<b>Final Outcome</b> <i>(who prevailed)</i>

Make as many copies of this sheet as necessary in order to **provide a 10 year history** of the requested information. If there is no action pending or action taken in the last 10 years, complete the **company name** and write **“NONE”** in the first **“Type of Incident”** box of this page and return with your submission package. This form should also include the primary partners listed in your submission. Do not include litigation with your company as the plaintiff. Final outcome should include who prevailed and what method of settlement was made. If a monetary settlement was made the amount may remain anonymous. **Please do not modify this form (expansion of spacing allowed) or submit your own variation.**

Page Number: \_\_\_\_\_ Of \_\_\_\_\_ Total pages  
 Update the page number to reflect the current page and the total number of pages. Example: Page 3, of 5 total submitted pages of this form.



**AFFIDAVIT PRINCIPAL PLACE OF BUSINESS**

Local Vendor Preference (Non-CCNA)  
(Lee County Ordinance No. 08-26)  
Location Identification (CCNA)

Instructions: Please complete all information that is applicable to your firm

Company Name: \_\_\_\_\_

Printed name of authorized signer \_\_\_\_\_

Title \_\_\_\_\_

⇒  
Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

The signee of this Affidavit guarantee, as evidenced by the sworn affidavit required herein, the truth and accuracy of this affidavit to interrogatories hereinafter made. **LEE COUNTY RESERVES THE RIGHT TO REQUEST SUPPORTING DOCUMENTATION, AS EVIDENCE OF SERVICES PROVIDED, AT ANY TIME.**

Notary:  
State of \_\_\_\_\_  
County of \_\_\_\_\_

The foregoing instrument was signed and acknowledged before me this \_\_\_\_\_ day of \_\_\_\_\_

20\_\_\_\_\_, \_\_\_\_\_ who has produced

\_\_\_\_\_ as identification (or personally known)  
Type of ID and number

⇒  
Notary Public Signature \_\_\_\_\_

Notary Commission Number and expiration \_\_\_\_\_

1. Principal place of business is located within the boundaries of: \_\_\_\_\_ Lee County  
\_\_\_\_\_ Collier County  
\_\_\_\_\_ Non-Local

Local Business Tax License # \_\_\_\_\_

2. Address of Principal Place of Business: \_\_\_\_\_

3. Number of years at this location \_\_\_\_\_ years

4. Have you provided goods or services to Lee County on a regular basis within the past 3 consecutive years \_\_\_\_\_ Yes\* \_\_\_\_\_ No \*If yes, attach contractual history for past 3 consecutive years

5. Size of Facility (i.e. office, sales area, warehouse, storage yard, etc.) \_\_\_\_\_

6. Number of available employees for this contract \_\_\_\_\_



This form must be signed and sworn to in the presence of a notary public or other officer authorized to administer oaths.

1. This sworn statement is submitted to \_\_\_\_\_  
(Print name of the public entity)

by \_\_\_\_\_  
(Print individual's name and title)

for \_\_\_\_\_  
(Print name of entity submitting sworn statement)

whose business address is \_\_\_\_\_

(If applicable) its Federal Employer Identification Number (FEIN) is \_\_\_\_\_

(If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement: On the attached sheet.) Required as per IRS Form W-9.

2. I understand that a "public entity crime" as defined in Paragraph 287.133(1) (g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or with the United States, including but not limited to, and bid or contract for goods or services to be provided to any public entity or agency or political subdivision or any other state or of the United States, and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

3. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1) (b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

4. I understand that "affiliate" as defined in Paragraph 287.133(1)(a), Florida Statutes, means:  
1. A predecessor or successor of a person convicted of a public entity crime:  
or:  
2. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those offices, directors, executives, partners, shareholders, employees, members and agents who are active in the management of the affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not fair market value under an arm's length Agreement/Contract, shall be a facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that a "person" as defined in Paragraph 287.133(1) (c), Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter a binding contract and which bids or applies to bid on contracts for the provision of goods or services let by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of the entity.

6. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting those sworn statement. (Please indicate which statement applies.)

\_\_\_\_\_ Neither the entity submitted this sworn statement, nor any officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity nor affiliate of the entity have been charged with and convicted of a public entity crime subsequent to July 1, 1989.

*Public Entity Crime Form*

\_\_\_\_\_ The entity submitting this sworn statement, or one or more of the officers, directors, executives, partners, shareholders, employees, member, or agents who are active in management of the entity, or an affiliate of the entity have been charged with and convicted of a public entity crime subsequent to July 1, 1989.

\_\_\_\_\_ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, member, or agents who are active in management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearing and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the entity submitting this sworn statement on the convicted vendor list. (Attach a copy of the final order)

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, FLORIDA STATUTES, FOR CATEGORY TWO OR ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

STATE OF \_\_\_\_\_  
COUNTY OF \_\_\_\_\_

PERSONALLY APPEARED BEFORE ME, the undersigned authority, \_\_\_\_\_

(Name of individual signing)

who, after first being sworn by me, affixed his/her signature in the space provided above on this \_\_\_\_\_ day of \_\_\_\_\_, 2\_\_\_\_\_.

\_\_\_\_\_  
(NOTARY PUBLIC)

My Commission Expires: \_\_\_\_\_

**Form#8: Trench Safety (Required for Construction Projects Only)**

**TRENCH SAFETY**

Contractor/Vendor acknowledges that included in the appropriate solicitation items of the solicitation and in the Total solicitation price are costs for complying with the Florida Trench Safety Act (90-96, Laws of Florida) effective October 1, 1990. The contractor/vendor further identifies the costs of such compliance to be summarized below:

Trench Safety Measure (Description)	Units of Measure (LF, SF)	Unit (Quantity)	Unit Cost	Extended Cost
.....				
A. _____	_____	_____	_____	_____
B. _____	_____	_____	_____	_____
C. _____	_____	_____	_____	_____
D. _____	_____	_____	_____	_____
TOTAL \$ _____				

If applicable, the contractor/vendor certifies that all trench excavation done within his control in excess of five (5') feet in depth shall be in accordance with the Florida Department of Transportation's Special Provisions Article 125-1 and Sub-article 125-4.1 (TRENCH EXCAVATION SAFETY SYSTEM AND SHORING, SPECIAL-TRENCH EXCAVATION).

Failure to complete the above may result in the solicitation being declared non-responsive.

\_\_\_\_\_  
*(Signature)*

\_\_\_\_\_  
*(Company Name)*

STATE OF \_\_\_\_\_  
COUNTY OF \_\_\_\_\_

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_ by \_\_\_\_\_ *(name and title of corporate officer)* of \_\_\_\_\_ *(name of corporation)*, a \_\_\_\_\_ *(state or place of incorporation)* corporation, on behalf of the corporation. He/she is personally known to me or has produced \_\_\_\_\_ *(type of identification)* as identification.

\_\_\_\_\_  
*(signature line for notary public)*

\_\_\_\_\_  
*(name of notary typed, printed or stamped)*

\_\_\_\_\_  
*(title or rank)*

My commission expires:  
\_\_\_\_\_

\_\_\_\_\_  
*(serial number, if any)*

BID BOND

Complete EITHER Lee County Paper Bid Bond OR provide cashier's check

KNOW ALL MEN BY THESE PRESENTS, that we

\_\_\_\_\_ as Principal, and  
(BIDDER'S Name)

\_\_\_\_\_ a Corporation licensed to do  
(Surety's Name)

business under the laws of the State of Florida as a Surety, are held and firmly bound unto LEE COUNTY BOARD OF COUNTY COMMISSIONERS, LEE COUNTY, FLORIDA, a Political Subdivision of the State of Florida,

in the SUM OF \_\_\_\_\_  
for the payment whereof, well and truly to be made, we bind ourselves, our heirs, successors, personal representatives and assigns, jointly and severally, firmly, by these presents.

SIGNED AND SEALED this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_

WHEREAS, said Principal is herewith submitting a Bid/Proposal for the construction of:

NOW, THEREFORE, the condition of the above obligation is such that if said Principal shall be awarded the Contract upon said Bid/Proposal within the specified time and shall enter into a written Contract, satisfactory in form, provide an acceptable Public Payment & Performance Bond from a Surety acceptable to the COUNTY and provide other Insurance as may be required to the COUNTY within seven (7) calendar days after the written Notice of Award date, or within such extended period as the COUNTY may grant, then this obligation shall be null and void; otherwise said Principal and Surety shall pay to said COUNTY in money the difference between the amount of the Bid of said Principal and the amount for which said COUNTY may legally contract with another party to perform said work, if the latter amount be in excess of the former, together with any expenses and reasonable attorney's fees incurred by said COUNTY if suit be brought here on, but in no event shall said Surety's liability exceed the penal sum hereof plus such expenses and attorney's fees. For purposes of unsuccessful bid protests filed by the Principal herein, this obligation shall bind the Surety to pay costs and damages associated with the bid protest or delays to the project upon a finding from the Board of County Commissioners for Lee County that the bid protest was frivolous and/or lacked merit. The liability of the Surety shall not exceed the penal sum of the bid bond.

Witness as to Principal: \_\_\_\_\_ (SEAL)  
(Principal)

\_\_\_\_\_  
(By) Printed Name

Witness as to Surety: \_\_\_\_\_ (SEAL)  
(Surety's Name)

\_\_\_\_\_  
(By-As Attorney-in-Fact, Surety)

Affix Corporate Seals and attach proper Power of Attorney for Surety.



**Cut along the outer border and affix this label to your sealed solicitation envelope to identify it as a "Sealed Bid".**

<b>SEALED BID DOCUMENTS • DO NOT OPEN</b>	
BID NO.:	B170199DLK
BID TITLE:	<b>North Lee County Water Treatment Plant RO Concentrate Acid Feed System</b>
DATE DUE:	<b>Tuesday, April 18, 2017</b>
TIME DUE:	<b>Prior to: 2:30 PM</b>
SUBMITTED BY:	_____ (Name of Company)
e-mail address	Telephone
<b>DELIVER TO:</b>	Lee County Procurement Management 1500 Monroe 4 <sup>th</sup> Floor Fort Myers FL 33901
<i>Note: submissions received after the time and date above will not be accepted.</i>	



Lee County Procurement Management  
1500 Monroe Street, 4<sup>th</sup> Floor  
Fort Myers, FL 33901  
(239) 533-8881  
[www.leegov.com/procurement](http://www.leegov.com/procurement)

**PLEASE PRINT CLEARLY**