INVITATION FOR BID
CONSTRUCTION
NO. 22-TA004368SAM
MASTER LIFT STATION N1-B
REHABILITATION
PROJECT NO. 6022388 & 6022389
SEPTEMBER 16, 2022

Manatee County BCC
Procurement Division
1112 Manatee Avenue West Ste 803
Bradenton, FL 34205
purchasing@mymanatee.org

ADVERTISEMENT

INVITATION FOR BID CONSTRUCTION NO. 22-TA004368SAM
MASTER LIFT STATION N1-B REHABILITATION

Manatee County, a political subdivision of the State of Florida (hereinafter referred to as County), will receive sealed bids from individuals, corporations, partnerships, and other legal entities authorized to do business in the State of Florida, to provide Master Lift Station N1-B Rehabilitation, as specified in this Invitation for Bid Construction to include master lift station rehabilitation.

DATE, TIME AND PLACE DUE:
The Due Date and Time for submission of Bids in response to this Invitation for Bid Construction (IFBC) **is October 25, 2022 at 2:00 PM ET.** Bids must be delivered to the following location: Manatee County Administration Building, 1112 Manatee Ave. W., Suite 803, Bradenton, FL 34205 prior to the Due Date and Time.

SOLICITATION INFORMATION CONFERENCE:
A non-mandatory site visit will be conducted at 9:30 AM ET on September 29, 2022 at Master Lift Station N1-B, 2903 69th Court, Palmetto, FL 34221. Attendance to non-mandatory information conferences is not required, but is strongly encouraged.

DEADLINE FOR QUESTIONS AND CLARIFICATION REQUESTS:
The deadline to submit all questions, inquiries, or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid Construction to the Manatee County Procurement Division is October 7, 2022. Questions and inquiries should be submitted via email to the Designated Procurement Contact shown below.

Important: A prohibition of lobbying is in place. Review Section A.13 carefully to avoid violation and possible sanctions.

DESIGNATED PROCUREMENT CONTACT: Sherri Meier, Procurement Team Leader
(941) 749-3042, Fax (941) 749-3034
Email: sherri.adamsmeier@mymanatee.org
Manatee County Financial Management Department
Procurement Division

AUTHORIZED FOR RELEASE: Jacob Erickson, MBA, CPPO, NIGP-CPP

Digitally signed by Jacob Erickson, MBA, CPPO, NIGP-CPP
Date: 2022.09.15 07:50:55 -04'00'

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SECTION A, INFORMATION FOR BIDDERS

To receive consideration, entities who submit a response to this Invitation for Bid Construction (Bidders) must meet the minimum qualification requirements and comply with the following instructions. Bid responses (Bids) will be accepted from single business entities, joint ventures, partnerships or corporations.

A.01 BID DUE DATE

The Due Date and Time for submission of Bids in response to this Invitation for Bid Construction (IFBC) **is October 25, 2022 at 2:00 PM ET.** Bids must be delivered to the following location: Manatee County Administration Building, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205 and time stamped by a Procurement representative prior to the Due Date and Time.

Bids received after the Due Date and Time will not be considered. It will be the sole responsibility of the Bidder to deliver its Bid to the Manatee County Procurement Division for receipt on or before the Due Date and Time. If a Bid is sent by U.S. Mail, courier or other delivery services, the Bidder will be responsible for its timely delivery to the Procurement Division. Bids delayed in delivery will not be considered, will not be opened at the public opening, and arrangements will be made for their return at the Bidder's request and expense.

A.02 SOLICITATION INFORMATION CONFERENCE AND SITE VISIT:

A non-mandatory site visit will be conducted at 9:30 AM ET on September 29, 2022 at Master Lift Station N1-B, 2903 69th Court, Palmetto, FL 34221. Attendance to non-mandatory site visit is not required, but is strongly encouraged.

Attendance to mandatory information conferences and/or site visits are required to meet the minimum qualification requirements of the IFBC. Attendance to non-mandatory information conferences and/or site visit is not required, but is strongly encouraged.

A.03 PUBLIC OPENING OF BIDS

Bids will be opened immediately following the Due Date and Time at the Manatee County Administration Building, Suite 803 in the presence of County officials. Bidders or their representatives may attend the Bid opening.

Manatee County will make public at the opening the names of the business entities which submitted a Bid and the total bid price submitted. No review or analysis of the Bids will be conducted at the Bid opening.

A.04 SUBMISSION OF BIDS

The contents of the Bid sealed package must include:

- One (1) bound original clearly identifying Bidder and marked “ORIGINAL”.
- One (1) electronic format copy clearly identifying Bidder.

Electronic format copy should be submitted on a Universal Serial Bus (USB) portable

flash memory drive or compact disc (CD) in Microsoft Office® or Adobe Acrobat® portable document format (PDF) in one continuous file. Do not password protect or otherwise encrypt electronic Bid copies. Electronic copies must be searchable and contain an identical Bid to the original.

Submit the Bid package in a sealed container with the following information clearly marked on the outside of the package: IFBC NO. 22-TA004368SAM, Master Lift Station N1-B Rehabilitation, Bidder's name, and Bidder's address. Bids must be delivered to the Manatee County Procurement Division prior to the Due Date and Time at the following address:

Manatee County Procurement Division
1112 Manatee Avenue West, Suite 803
Bradenton, FL 34205

A.05 DISTRIBUTION OF SOLICITATION DOCUMENTS

All documents issued pursuant to this IFBC are distributed electronically and available for download at no charge at www.mymanatee.org > *Bids and Proposals.* Documents may be viewed and downloaded for printing using Adobe Reader® software.

At its sole discretion, the County may utilize third-party providers to distribute proposals. Visit the third-party's website for more information regarding this service. Participation in the third-party system is not a requirement for doing business with Manatee County.

Additionally, the IFBC and all related documents are available for public inspection at the Manatee County Procurement Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205. Call (941) 749-3014 to schedule an appointment. Documents are available between the hours of 8:00 A.M. and 5:00 P.M., Monday through Friday, with the exception of County holidays.

As a courtesy, Manatee County notifies the Manatee County Chamber of Commerce and the Manatee County Black Chamber of Commerce of all active solicitations, who then distributes the information to its members.

A.06 EXAMINATION OF BID DOCUMENTS AND SITE(S)

It is the responsibility of each bidder before submitting a bid, to (a) examine the IFBC documents thoroughly; (b) visit the Project Site(s) to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work; (c) consider federal, state, and local codes, laws, and regulations that may affect costs, progress, performance, or furnishing of the Work; (d) study and carefully correlate bidder's observations with the IFBC documents; and (e) notify County in writing of all conflicts, errors, or discrepancies in the IFBC documents.

Each bidder may, at bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies, and obtain any additional information and data which pertain to the physical conditions at or contiguous to the Project Site(s) or

otherwise which may affect cost, progress, performance or furnishing of the Work and which bidder deems necessary to determine his bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the IFBC documents. County will provide each bidder access to the site(s) to conduct such explorations and tests.

Bidder shall fill all holes, clean up and restore the Project Site(s) to its former condition upon completion of such explorations. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by successful bidder in performing the Work are identified in the IFBC documents.

All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by successful bidder. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by County unless otherwise provided in the IFBC documents.

Inspection of the Project Site(s) is not a requirement to be considered for award of this bid. Prior to submitting a bid, each bidder shall examine the Project Site(s) and all conditions thereon fully familiarizing themselves with the full scope of the Work. Failure to become familiar with Project Site conditions will in no way relieve the successful bidder from the necessity of furnishing any materials or performing any Work that is required to complete the Project in accordance with the Project Plans and Specifications. Bidder shall acknowledge inspection of the Project Site(s) on his/her signed, submitted Bid Form.

A.07 ADDENDA

Any interpretations, corrections or changes to this IFBC will be made by addenda. Addenda will be posted on the Procurement Division's web page of the County website at http://www.mymanatee.org/purchasing > *Bids and Proposals*. For those solicitations that are advertised on a third-party website, addenda will also be posted on the third-party's distribution system on the 'Planholders' link.

All addenda are a part of the IFBC and each Bidder will be bound by such addenda. It is the responsibility of each Bidder to read and comprehend all addenda issued. Failure of any Bidder to acknowledge an issued addendum in its Bid will not relieve the Bidder from any obligation contained therein.

A.08 BID FORMS

Bids must include the forms provided in this IFBC. If needed, additional pages may be attached to a form. Bidders must fully complete and execute all Bid Forms. Bid Forms must be executed by an authorized official of the company who has the legal authority to bind the company.

A.09 BID EXPENSES

All costs incurred by Bidder in responding to this IFBC will be the sole responsibility of

the Bidder.

A.10 QUESTION AND CLARIFICATION PERIOD

Each Bidder shall examine all IFBC documents and will judge all matters relating to the adequacy and accuracy of such documents. Any questions or requests concerning interpretation, clarification or additional information pertaining to this IFBC, including the sample Agreement, shall be made in writing via email to the Manatee County Procurement Division to the Designated Procurement Contact or to purchasing@mymanatee.org. All questions received and responses given will be provided to potential bidders via an addendum to this IFBC.

Manatee County will not be responsible for oral interpretations given by other sources including County staff, representative, or others. The issuance of a written addendum by the Procurement Division is the only official method whereby interpretation, clarification or additional information will be given.

A.11 FALSE OR MISLEADING STATEMENTS

Bids which contain false or misleading statements, or which provide references which do not support an attribute or condition claimed by the Bidder, may be rejected. If, in the opinion of the County, such information was intended to mislead the County in its evaluation of the Bid, and the attribute, condition or capability is a requirement of this IFBC. Such Bidder will be disqualified from consideration for this IFBC and may be disqualified from submitting a response on future solicitation opportunities with the County.

A.12 CONFIDENTIALITY OF SECURITY RELATED RECORDS

a. Pursuant to Florida Statutes § 119.071(3), the following records (hereinafter referred to collectively as "the Confidential Security Records") are confidential and exempt from the disclosure requirements of Florida Statutes § 119.07(1):

   i. A Security System Plan or portion thereof for any property owned by or leased to County or any privately owned or leased property held by County.
   ii. Building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout and structural elements of a building, arena, stadium, water treatment facility, or other structure owned or operated by County.
   iii. Building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout or structural elements of an attractions and recreation facility, entertainment or resort complex, industrial complex, retail and service development, office development, or hotel or motel development in the possession of, submitted to County.

b. Successful Bidder agrees that, as provided by Florida Statute, it shall not, as a result of a public records request, or for other reason disclose the contents of, or release or provide copies of the Confidential Security Records to any other party absent the express written authorization of County's Property Management Director or to comply

with a court order requiring such release or disclosure. To the extent successful Bidder receives a request for such records, it shall immediately contact the County's designated Contract administrator who shall coordinate County's response to the request.

A.13 LOBBYING

After the issuance of any IFBC, prospective bidders, bidders, or their agents, representatives or persons acting at the request of such bidder shall not contact, communicate with or discuss any matter relating to the IFBC with any officer, agent or employee of Manatee County other than the Purchasing Official or the contact identified in this IFBC, pursuant to the Manatee County Code of Laws. This prohibition includes copying such persons on all written communication, including email correspondence. This requirement begins with the issuance of an IFBC and ends upon execution of the final Agreement or when the IFBC has been cancelled. Violators of this prohibition shall be subject to sanctions as provided in the Manatee County Code of Laws.

A.14 UNBALANCED BIDDING PROHIBITED

County recognizes that large and/or complex projects will often result in a variety of methods, sources, and prices. However, where in the opinion of the County such variation does not appear to be justified given bid requirements and industry and market conditions, the Bid will be presumed to be unbalanced. Examples of unbalanced Bids will include:

a. Bids showing omissions, alterations of form, additions not specified, or required conditional or unauthorized alternate bids.
b. Bids quoting prices that substantially deviate, either higher or lower, from those included in the Bids of competitive Bidders for the same line item unit costs.
c. Bids where the unit costs offered are in excess of, or below reasonable cost analysis values.

In the event County determines that a Bid is presumed unbalanced, it will request the opportunity to and reserves the right to, review all source quotes, bids, price lists, letters of intent, and other supporting documentation which the Bidder obtained and upon which the Bidder relied upon to develop its Bid. County reserves the right to deem any presumptive unbalanced Bid where the Bidder is unable to demonstrate the validity and/or necessity of the unbalanced unit costs as non-responsive.

A.15 FRONT LOADING OF BID PRICING PROHIBITED

Prices offered for performance and/or acquisition activities which occur early in the Project Schedule, such as mobilization; clearing and grubbing; or maintenance of traffic; that are substantially higher than pricing of competitive bidders within the same portion of the Project Schedule, will be presumed to be front loaded. Front loaded bids could reasonably appear to be an attempt to obtain unjustified early payments creating a risk of insufficient incentive for the bidder to complete the Work or otherwise creating an appearance of an undercapitalized bidder.

In the event County determines that a bid is presumed to be front loaded, it will request the opportunity to, and reserves the right to, review all source quotes, bids, price lists, letters of intent, and other documents which the bidder obtained and upon which the bidder relied upon to develop the pricing or acquisition timing for these bid items. County reserves the right to reject as nonresponsive any presumptive front-loaded bids where the bidder is unable to demonstrate the validity and/or necessity of the front-loaded costs.

A.16 WITHDRAWAL OR REVISION OF BIDS

Bidders may withdraw Bids under the following circumstances:

a. If Bidder discovers a mistake(s) prior to the Due Date and Time. Bidder may withdraw its Bid by submitting a written notice to the Procurement Division. The notice must be received in the Procurement Division prior to the Due Date and Time for receiving Bids. A copy of the request shall be retained, and the unopened Bid returned to the Bidder; or

b. After the Bids are opened but before a contract is signed, Bidder alleges a material mistake of fact if:

    1. The mistake is clearly evident in the solicitation document; or
    2. Bidder submits evidence which clearly and convincingly demonstrates that a mistake was made in the Bid. Request to withdraw a Bid must be in writing and approved by the Purchasing Official.

A.17 IRREVOCABLE OFFER

Any Bid may be withdrawn up until the Due Date and Time. Any Bid not so withdrawn shall, upon opening, constitute an irrevocable offer for a period of one hundred twenty (120) days to provide the goods or services set forth in this IFBC or until one or more of the Bids have been duly accepted by County, whichever occurs first.

A.18 RESERVED RIGHTS

County reserves the right to accept or reject any and/or all bids, to waive irregularities and minor technicalities, and to request resubmission. Also, County reserves the right to accept all or any part of the bid and to increase or decrease quantities to meet additional or reduced requirements of County. Any sole response received by the first submission date may or may not be rejected by County depending on available competition and current needs of County. For all items combined, the bid of the lowest, responsive, responsible bidder will be accepted, unless all bids are rejected.

The lowest, responsible bidder shall mean that Bidder who makes the lowest Bid to sell goods and/or services of a quality which meets or exceeds the quality of goods and/or services set forth in the IFBC documents or otherwise required by County.

To be responsive, a Bidder shall submit a Bid which conforms in all material respects to the requirements set forth in the IFBC.

To be a responsible bidder, the bidder shall have the capability in all respects to perform fully the bid requirements, and the tenacity, perseverance, experience, integrity, reliability, capacity, facilities, equipment, and credit which will assure good faith performance.

Also, County reserves the right to make such investigation as it deems necessary to determine the ability of any bidder to furnish the service requested. Information County deems necessary to make this determination shall be provided by the bidder. Such information may include, but shall not be limited to current financial statements, verification of availability of equipment and personnel, and past performance records.

A.19 APPLICABLE LAWS

Bidder must be authorized to transact business in the State of Florida. All applicable laws and regulations of the State of Florida and ordinances and regulations of Manatee County will apply to any resulting Agreement. Any involvement with the Manatee County Procurement Division shall be in accordance with the Manatee County Procurement Ordinance as amended.

A.20 COLLUSION

By submitting a bid in response to this IFBC, Bidder certifies that it has not divulged, discussed or compared its bid with any other bidder, and has not colluded with any other bidder or parties to this bid whatsoever. Further, Bidder, and in the case of a joint bid each party thereto, certifies as to their own organization, that in connection with this IFBC that:

a. All prices and/or cost data submitted have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices and/or cost data, with any other bidder or with any competitor;

b. All prices and/or cost data quoted for this bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder, prior to the scheduled opening, directly or indirectly to any other bidder or to any competitor;

c. No attempt has been made, or will be made, by Bidder to induce any other person or firm to submit or not to submit a bid for the purpose of restricting competition;

d. The only person or persons interested in this bid is/are named in Bidder's Bid and that no person other than those identified has any interest in the Bid or in the resulting Agreement to be entered into.

e. No person or agency has been employed or retained to solicit or secure the resulting Agreement upon an agreement or understanding or a commission, percentage, brokerage, or contingent fee except bona fide employees or established commercial agencies maintained by Bidder for purpose of doing business.

A.21 CODE OF ETHICS

With respect to this and any bid, if a Bidder violates, directly or indirectly, the ethics provisions of the Manatee County Procurement Code and/or Florida criminal or civil laws related to public procurement, including but not limited to Florida Statutes Chapter 112, Part II, Code of Ethics for Public Officers and Employees, such Bidder will be ineligible for award to perform the work described in this IFBC, and may be disqualified from submitting on any future quote or bid requests to supply goods or services to Manatee County. By submitting a bid, the Bidder represents to County that all statements made, and materials submitted are truthful, with no relevant facts withheld.

A.22 PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime, as that term is defined in Section 287.133, Florida Statutes, may not submit a bid to provide any goods or services to a public entity; may not submit a bid 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 be awarded or perform Work as a contractor, supplier, Subcontractor, or consultant under an agreement with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, Florida Statutes, for CATEGORY TWO for a period of thirty-six (36) months following the date of being placed on the convicted list.

In addition, the Manatee County Code of Laws prohibits the award of any bid to any person or entity who/which has, within the past five (5) years, been convicted of, or admitted to in court or sworn to under oath, a public entity crime or of any environmental law that, in the reasonable opinion of the Purchasing Official, establishes reasonable grounds to believe the person or business entity will not conduct business in a responsible matter.

To ensure compliance with the foregoing, the Code requires all persons or entities desiring to do business with County to execute and file with the Purchasing Official an affidavit, executed under the pain and penalties of perjury, confirming that person, entity and any person(s) affiliated with the entity, does not have such a record and is therefore eligible to seek and be awarded business with County. In the case of a business entity other than a partnership or a corporation, such affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, such affidavit shall be executed by the general partner(s). A Public Contracting and Environmental Crimes Certification form is attached herein for this purpose.

A.23 SCRUTINIZED COMPANIES

Florida Statutes § 287.135, as amended from time to time, may contain limitations on the part of a company to conduct business with the County. Submission of a response to this solicitation shall be subject to all procedural requirements contained within that statute including the submission of any required certification of eligibility to contract with the County. It shall be the responsibility of the company responding to this solicitation to concurrently review the current version of the statute and ensure it is compliant. To the

extent a certification is required, it shall be provided on the form located at Appendix F *Vendor Certification Regarding Scrutinized Companies Lists*.

A.24 AGREEMENT

The successful Bidder will be required to execute the Agreement, a sample of which is attached hereto and made a part hereof. The County will transmit the Agreement to the successful Bidder for execution. The successful Bidder agrees to deliver the required number of duly executed copies of the Agreement, with any other required documents, to the County within ten calendar days of receipt.

A.25 LEGAL NAME

Bidders shall clearly indicate the full legal name, including any d/b/a, address, email address, and telephone number on the Bid Form. Bid Forms shall be signed above the typed or printed name and title of the signer. The signer must be an official of the organization and have the authority to bind the bidder to the submitted bid.

When bidder is a partnership, the Bid Form shall be signed in the name of the firm and by all partners required under the terms of the partnership agreement. When a corporation is a bidder, the authorized corporate officers shall sign.

Bidders who are corporations or limited partnerships shall provide a certified copy of their permit to transact business in the State of Florida, preferably along with the Bid Form, or within forty-eight (48) hours after request by County.

When submitting a bid as a joint venture, it must have filed paper documents with the Division of Profession's Construction Industry Licensing Board prior to submitting a bid.

A.26 DISCOUNTS

All discounts must be incorporated in the prices contained in the bid and not shown separately. Unless otherwise specified in this IFBC, pricing must be all inclusive, including delivery costs. The prices indicated on the Pricing Form shall be the prices used in determining award.

A.27 TAXES

Manatee County is exempt from Federal Excise and State Sales Taxes. (F.E.T. Cert. No. 59-78-0089K; Florida Sales Tax Exempt Cert. No. 85-8012622206C-6). Therefore, the Bidder is prohibited from delineating a separate line item in its bid for any sales or service taxes.

The successful Bidder will be responsible for the payment of taxes of any kind, including but not limited to sales, consumer, use, and other similar taxes payable on account of the work performed and/or materials furnished under the award in accordance with all applicable laws and regulations.

A.28 QUALITY

Unless otherwise specifically provided in the IFBC documents, all goods provided shall

be new, the latest make or model, of the best quality, of the highest grade of workmanship, and of the most suitable for the purpose intended.

Unless otherwise specifically provided in the IFBC documents, 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.

A.29 AUTHORIZED PRODUCT REPRESENTATION

Bidder, by virtue of submitting the name and specifications of a manufacturer's product, will be required to furnish the named manufacturer's product. Failure to do so may, in the County's sole discretion, be deemed a material breach of the resulting agreement and shall constitute grounds for County's immediate termination of the resulting agreement.

A.30 ROYALTIES AND PATENTS

The successful Bidder shall pay all royalties and license fees for equipment or processes in conjunction with the equipment and/or services being furnished. Successful Bidder shall defend all suits or claims for infringement of any patent, trademark or copyright, and shall save County harmless from loss on account thereof, including costs and attorney's fees.

A.31 AMERICANS WITH DISABILITIES ACT

Manatee County does not discriminate upon the basis of any individual's disability status. This non-discrimination policy involves every aspect of County's functions including one's access to participation, employment, or treatment in its programs or activities. Anyone requiring reasonable accommodation for an information conference or bid opening should contact the person named on the cover page of this document at least twenty-four (24) hours in advance of either activity.

A.32 EQUAL EMPLOYMENT OPPORTUNITY

In accordance with Title VI of the Civil Rights Act of 1964, Title 15, Part 8 of the Code of Federal Regulations and the Civil Rights Act of 1992, Manatee County hereby notifies all Bidders that it will affirmatively ensure minority business enterprises are afforded full opportunity to participate in response to this IFBC and will not be discriminated against on the grounds of race, color, national origin, religion, sex, age, handicap, or marital status in consideration of award.

A.33 MINORITY AND/OR DISADVANTAGED BUSINESS ENTERPRISES

The State of Florida Office of Supplier Diversity provides the certification process and maintains the database of certified MBE/DBE firms. Additional information may be obtained at https://www.dms.myflorida.com/agency_administration/office_of_supplier_diversity_osd or by calling (850) 487-0915.

A.34 DELIVERY

Unless otherwise specified, all prices shall include all delivery cost (FOB Destination).

A.35 MATHEMATICAL ERRORS

a. Bid pricing forms without imbedded mathematical formulas: In the event of multiplication/extension error(s), the unit price shall prevail. In the event of addition error(s) the extension totals will prevail. In the event the dollar amount for contract contingency is omitted, it will be added to the total price of the Bid.

b. Bid pricing forms with imbedded mathematical formulas: Interactive bid pricing forms that contain mathematical formulas may be provided to automate lengthy and complex bid forms. In the event bid pricing forms with imbedded formulas are used and a multiplication/extension error(s) is discovered in the formula, the unit price entered by the Bidder shall prevail.

c. Bidder shall assume the responsibility and accuracy of the information input in the bid pricing form and therefore shall verify that the calculations are correct before submitting its Bid.

d. Regardless of the type of bid pricing form used, all Bids shall be reviewed mathematically by the County using these standards.

A.36 SUBCONTRACTORS

The successful bidder will obtain prior written approval from the County for any subcontractor(s) and the work each will perform. A subcontractor is defined as any entity performing work within the scope of the project who is not an employee of the successful Bidder.

Bidders subcontracting any portion of the work shall include a list of subcontractors along with their bid. The list shall include: name and address of subcontractor, type of work to be performed and the percent of the contract amount to be subcontracted.

A.37 E-Verify

Prior to the employment of any person under this contract, the successful Bidder shall utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of (a) all persons employed during the contract term by the successful Bidder to perform employment duties within Florida and (b) all persons, including subcontractors, assigned by the successful Bidder to perform work pursuant to the contract with Manatee County. For more information on this process, please refer to United States Citizenship and Immigration Service site at: http://www.uscis.gov/.

Only those individuals determined eligible to work in the United States shall be employed under this contract.

By submission of a bid in response to this IFBC, the successful Bidder commits that all employees and subcontractors will undergo e-verification before placement on this contract.

The successful Bidder shall maintain sole responsibility for the actions of its employees

and subcontractors. For the life of the contract, all employees and new employees brought in after contract award shall be verified under the same requirement stated above.

A.38 DISCLOSURE

Upon receipt, all inquiries and responses to inquiries related to this IFBC become "Public Records," and shall be subject to public disclosure consistent with Florida Statues, Chapter 119.

Bids become subject to disclosure thirty (30) days after the opening or if a notice of intent to award decision is made earlier than this time as provided by Florida Statutes § 119.071(1)(b). No announcement or review of the bids shall be conducted at the public opening.

Based on the above, County will receive bids at the time and date stated and will make public at the opening the names of the business entities of all that submitted a bid.

If County rejects all bids and concurrently notices its intent to reissue the solicitation, the rejected bids are exempt from public disclosure until such time as County provides notice of an intended decision concerning the reissued solicitation or until County withdraws the reissued solicitation. A bid is not exempt for longer than twelve (12) months after the initial notice rejecting all bids.

Pursuant to Florida Statutes 119.0701, to the extent successful Bidder is performing services on behalf of the County, successful Bidder must:

a. Keep and maintain public records required by public agency to perform the service.

b. Upon request from the public agency's custodian of public records, provide the public agency 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 in Florida Statutes, Chapter 119, or as otherwise provided by law.

c. 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 successful Bidder does not transfer the records to the public agency.

d. Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of contractor or keep and maintain public records required by the public agency to perform the service. If the successful Bidder transfers all public records to the public agency upon completion of the contract, the successful Bidder shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the successful Bidder keeps and maintains public records upon completion of the contract, the successful Bidder shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from public

agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

IF THE SUCCESSFUL BIDDER HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE SUCCESSFUL BIDDER'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO ANY RESULTING CONTRACT, CONTACT COUNTY'S CUSTODIAN OF PUBLIC RECORDS AT:

Phone: (941) 742-5845
Email: debbie.scaccianoce@mymanatee.org
Mail: Manatee County BCC
Attn: Records Manager
1112 Manatee Ave W.
Bradenton, FL 34205.

A.39 LOCAL PREFERENCE

Local business is defined as a business legally authorized to engage in the sale of the goods and/or services, and which certifies within its Bid that for at least six (6) full months prior to the advertisement of this IFBC it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota County with at least one full-time employee at that location.

Local preference shall not apply to the following categories of agreements:

a. Purchases or agreements which are funded, in whole or in part, by a governmental or other funding entity, where the terms and conditions governing the funds prohibit the preference.
b. Any bid announcement which specifically provides that local preference, as set forth in this section, is suspended due to the unique nature of the goods or services sought, the existence of an emergency as found by either the County Commission or County Administrator, or where such suspension is, in the opinion of the County Attorney, required by law.
c. For a competitive solicitation for construction services in which fifty percent (50%) or more of the cost will be paid from state.
d. To qualify for local preference under this section, **a local business must certify to County** by completing an "**Affidavit as to Local Business Form,"** which is available for download at www.mymanatee.org/vendor. Click on "Affidavit for Local Business" to access and print the form. Complete, notarize, and mail the notarized original to the following address: Manatee County Procurement Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205.
e. It is the responsibility of the bidder to ensure accuracy of the Affidavit as to Local Business and notify County of any changes affecting same.

A.40 VENDOR REGISTRATION

Registering your business will provide Manatee County a sourcing opportunity to identify suppliers of needed goods and services and identify local businesses. To register as a supplier with the County go to www.mymanatee.org/vendor. For assistance with supplier

registration, call the Procurement Division main number at (941) 749-3014. Office hours are Monday – Friday, 8:00 A.M. to 5:00 P.M., excluding County holidays.

A link to Vendor Registration is listed on the Procurement Division's web page at http://www.mymanatee.org/home/government/departments/financial-management/purchasing.html. Click on *"Register as a Vendor"*, then "*Vendor Registration Form"*. Registration is not mandatory to submit a Bid.

A.41 ENVIRONMENTAL SUSTAINABILITY

All bidders are encouraged to use as many environmentally preferable "green" products, materials, as supplies, as possible to promote a safe and healthy environment. Environmentally preferable are products or services that have a reduced adverse effect on the environment.

Bidder shall acknowledge in its Bid if Bidder has an environmental sustainability initiative. In addition, Bidder shall submit with its Bid a brief summary of Bidder's environmental sustainability initiative. This information will be used as a determining factor in the award decision when all other factors, including local preference, are otherwise equal.

A.42 ePAYABLES

Manatee County Board of County Commissioners and the Manatee County Clerk of the Circuit Court have partnered to offer the ePayables program, which allows payments to be made to vendors via credit cards.

The Clerk of the Circuit Court will issue a unique credit card number to vendor after goods are delivered or services rendered, vendors submit invoices to the remit to address on the purchase order. When payments are authorized, an email notification is sent to the vendor. The email notification includes the invoice number(s), invoice date(s), and amount of payment. There is no cost for vendors to participate in this program; however, there may be a charge by the company that processes your credit card transactions.

If Bidder is interested in participating in this program, complete the ePayables Application attached herein and return the completed form via email to tina.mancini@manateeclerk.com.

A.43 BASIS OF AWARD

County will not make award to a Bidder who is delinquent in payment of any taxes, fees, fines, contractual debts, judgments, or any other debts due and owed to the County, or is in default on any contractual or regulatory obligation to the County. By submitting this solicitation response, Bidder attests that it is not delinquent in payment of any such debts due and owed to the County, nor is it in default on any contractual or regulatory obligation to the County. In the event the Bidder's statement is discovered to be false, bidder will be subject to suspension and/or debarment and the County may terminate any award it has with bidder.

Award shall be to the lowest, responsive, responsible bidder(s) meeting specifications which includes delivery time requirements, qualification requirements, and having the lowest total offer for requirements listed on the Bid Form for the Work as set forth in this IFBC. Bid prices shall include costs for furnishing all labor, equipment and/or materials for the completion of the Work to the County's satisfaction, in accordance with and in the manner set forth and described in the IFBC documents and within the prescribed time.

Multiple schedules for completion of Work shall be considered. Two (2) bids shall be submitted and considered, Bid 'A' based on 270 calendar days completion time and Bid 'B' based on 230 calendar days completion time. County, at its sole discretion, shall select either Bid 'A' or Bid 'B', whichever is in the best interest of the County. Only one (1) award will be made.

In evaluating Bids, County shall consider the qualifications of the Bidders; and if required, may also consider the qualifications of the subcontractors, suppliers, and other persons and organizations proposed. County may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work.

Whenever two or more responsive, responsible bids which are equal with respect to price and all other evaluation factors are received, the bid from the local business shall be given preference in award.

Whenever two or more responsive, responsible bids which are equal with respect to price are received, and both or neither of these bids are from a local business, the award shall be determined by a chance drawing, coin toss, or similar tie-breaking method conducted by the Procurement Division and open to the public.

Bidder acknowledges that County has, or may hire, others to perform work similar to or the same as that which is within the scope of work of this IFBC. In the event that the successful Bidder cannot meet the delivery time or availability requirements of materials, the County, at its sole discretion can obtain the goods and services from other sources.

A.44 SCOPE OF WORK

The successful Bidder shall furnish and install all materials, equipment and labor which is reasonably inferable and necessary for the proper completion of the Work specified in this IFBC, whether specifically indicated in the IFBC or not.

The successful Bidder shall furnish all shop drawings, work drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all Work required by these Specifications.

The successful Bidder shall perform the Work complete, in place and ready for continuous service and shall include any repairs, replacements, and / or restoration required as a result of damages caused prior to acceptance by the County.

The successful Bidder shall perform work as shown in the plans and specifications.

A.45 COMPLETION OF WORK

The Work will be completed and ready for final inspection within the specified calendar days from the date the Contract Time commences to run. Completion time shall be based on Bid 'A' for 270 calendar days or Bid 'B' based on 230 calendar days time at the County's sole discretion.

A.46 LIQUIDATED DAMAGES

If the successful Bidder fails to achieve substantial completion of the Work within the contract time and as otherwise required by the Agreement (to include not only the entire Work but any portion of the Work as set forth therein), the County shall be entitled to retain or recover from the successful Bidder, as liquidated damages and not as a penalty, the sum of $1192.00 per calendar day, commencing upon the first day following expiration of the contract time and continuing until the actual date of substantial completion.

Such liquidated damages are hereby agreed to be a reasonable estimate of damages the County will incur because of delayed completion of the Work. The County may deduct liquidated damages as described in this paragraph from any unpaid amounts then or thereafter due the successful bidder under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the successful bidder shall be payable to the County at the demand of the County, together with interest from the date of the demand at the maximum allowable rate.

A.47 CONTRACT CONTINGENCY WORK

Contract contingency is a monetary allowance used solely at County’s discretion to handle unexpected conditions as required to satisfactorily complete the Work in accordance with the IFBC documents. A Field Directive must be issued by an authorized County representative to authorize use of contract contingency funds.

The percentage for contract contingency is listed on the Bid Form. Bidder shall enter the dollar amount for contract contingency based on the percentage of the total base bid. The total contract award will include contract contingency.

Appropriate uses of contract contingency include increases to existing bid item quantities that do not change the initial Scope of Work, which may be directed by County staff; modification items not originally bid which were unforeseen yet necessary during the Work to provide a safe, complete Project and that do not change the initial Scope of Work; and unanticipated conflicts and/or design changes required during construction which are necessary to provide a safe, complete Project and that do not change the initial Scope of Work.

Inappropriate uses of contract contingency include anything that changes the initial Scope of Work, including the Contract Sum and Contract Time, and adding bid items not previously contemplated that change the initial Scope of Work.

A.48 LICENSES AND PERMITS

The successful Bidder shall be solely responsible for obtaining all necessary license and permit fees, including, but not limited to, all license fees, permit fees, impact fees, or inspection fees, and responsible for the costs of such fees. Successful Bidder is solely responsible for ensuring all work complies with all Federal, State, local, and Manatee County ordinances, orders, codes, laws, rules, regulations, directives, and guidelines.

A.49 PROTEST

Any actual bidder, proposer, or contractor who is aggrieved in connection with the notice of intent to award of a contract with a value greater than $250,000 where such grievance is asserted to be the result of a violation of the requirements of the Manatee County Procurement Code or any applicable provision of law by the officers, agents, or employees of the County, may file a protest to the Purchasing Official.

Protest must be in writing and delivered via email at purchasing@mymanatee.org or by hand delivery to the Procurement Division at 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205 by 5:00 p.m. on the fifth business day following the date of posting of the Notice of Intent to Award on the County website. There is no stay of the procurement process during a protest. The Purchasing Official shall have the authority to settle and resolve a protest concerning the intended award of a contract.

For additional information regarding the County protest process, visit the Procurement Division webpage on the County website.

A.50 ACCESSIBILITY

The County is committed to making its documents and information technologies accessible to individuals with disabilities by meeting the requirements of Section 504 of the Rehabilitation Act and best practices (W3C WCAG 2). **For assistance with accessibility regarding this solicitation, contact the Manatee County Procurement Division via email at purchasing@mymanatee.org or by phone at 941-748-4501 X3014.**

Successful Bidder shall ensure all its electronic information, documents, applications, reports, and deliverables required under this Agreement are in a format that meets the requirements of Section 504 of the Rehabilitation Act and best practices (W3C WCAG 2).

Where not fully compliant with these requirements and best practices, Successful Bidder shall provide clear points of contact for each document and information technology to direct users in how to obtain alternate formats. Further, successful Bidder shall develop accommodation strategies for those non-compliant resources and implement strategies to resolve the discrepancies.

A.51 SOLICITATION SCHEDULE

The following schedule has been established for this Solicitation process. Refer to the County's website (www.mymanatee.org > Business > *Bids & Proposals*) for meeting

locations and updated information pertaining to any revisions to this schedule.

Scheduled Item	Scheduled Date
Non-Mandatory site tour, per Article A.02	September 29, 2022 @ 9:30 AM ET
Question and Clarification Deadline	October 7, 2022
Final Addendum Posted	October 17, 2022
Bid Response Due Date and Time	October 25, 2022, 2:00 PM, ET
Projected Award	November 2022

NOTE: Any statements contained in the Scope of Work, Bid Summary, Construction Agreement, General Conditions of the Construction Agreement and/or Exhibits which vary from the information in Section A, Information for Bidders, shall have precedence over the Information for Bidders.

END OF SECTION A

SECTION B, BID FORMS

(To be completed and returned with Bid)

APPENDIX A, MINIMUM QUALIFICATIONS

IFBC No. 22-TA004368SAM

Bidders must submit the information and documentation requested in this Attachment that confirms Bidder meets the following minimum qualification requirement(s):

1. Must have been registered with the State of Florida, Division of Corporations to do business in Florida.

   No documentation is required. The County will verify registration.

2. Bidder, or its representative(s), has made an inspection of the construction site for work specified in this IFBC on or after the date of advertisement of this IFBC and prior to the Due Date and Time.

   Bidder must submit a statement on company letterhead and signed by an authorized official of Bidder that Bidder, or its representative(s), has made an inspection of the construction site, listing the date of the inspection and the individuals, by name, who conducted the inspection.

3. Bidder, or Bidder's subcontractor combined must possess a General Contractor License issued by the Florida Department of Business and Professional Regulation for a period of at least five (5) consecutive years since October 1, 2017. License must be current and valid through the Due Date for submission of bids for this IFBC.

   If Bidding as a General Contractor License, provide a copy of the license, issued by the Florida Department of Business and Professional Regulation and documentation confirming Bidder or Bidders Subcontractor has been licensed and or certified for the period of October 1, 2017 through the date of submission of the bid.

4. Bidder or Bidder's subcontractor has provided lift station rehabilitation for at least three (3) projects since October 1, 2017, in which each project included the following components: (i) lift station rehabilitation; (ii) installation, testing, and startup of new submersible pumps; (iii) construction, plumbing, electrical and mechanical related to lift station rehabilitation. Project clients must be agreeable to responding to an inquiry by the County.

   Provide the following information for the three (3) qualifying project references.

   a) Name of client
   b) Project name
   c) Location (City/State)
   d) Client contact name
   e) Contact phone
   f) Contact email

g) Service dates (Start/End)

5. Bidder, on the day the bid is submitted, has a certified or registered Qualifying Agent, as required by Section 489.119, Florida Statues, and that Qualifying Agent has been the same Qualifying Agent of Bidder for a period of at least two (2) consecutive years, since October 1, 2020.

   Submit a copy of Bidder's Qualifying Agent's registration or certification along with supporting documentation confirming Qualifying Agent has been the Qualifying Agent for Bidder for two years, since October 1, 2020.

6. Bidder is not on the Florida Department of Management Services Suspended, Debarred, Convicted Vendor Lists.

   No documentation is required. The County will verify.

7. If Bidder is submitting as a joint venture must file the required documents with the Florida Department of Business and Professional Regulation as required by Florida Statute Section 489.119, prior to the Due Date and Time.

   If Bidder is a joint venture, provide a copy of Bidder's approved filing with the Florida Department of Business and Professional Regulation.

8. Bidder has no reported conflict of interests in relation to this IFBC.

   If no conflicts of interests are present, Bidder must submit a fully completed copy of Appendix J.

   If there is a potential conflict of interest, on a separate page submit a statement to that affect and disclose the name of any officer, director or agent who is an employee of the County. Disclose the name of any County employee who owns, directly or indirectly, any interest in Bidder's firm or any of its branches.

   END OF APPENDIX A

APPENDIX B, BIDDER'S QUESTIONNAIRE

IFBC No. 22-TA004368SAM

Bidder must fully complete and return this form with its Bid. Bidder warrants the truth and accuracy of all statements and answers herein contained. (Attach additional pages if necessary.)

THIS QUESTIONNAIRE MUST BE COMPLETED AND SUBMITTED WITH YOUR BID

1. Contact Information:

FEIN #: _____

License #: _____

License Issued to: _____

Date License Issued (MM/DD/YR): _____

Company Name: _____

Physical Address: _____

City: _____ State of Incorporation: _____ Zip Code: _____

Phone Number: ( ) _____ Fax Number: ( ) _____

Email address: _____

2. Bidding as: an individual __; a partnership __; a corporation __; a joint venture __

3. If a partnership, list names and addresses of partners; if a corporation, list names of officers, directors, shareholders, and state of incorporation; if joint venture, list names and address of ventures' and the same if any venture are a corporation for each such corporation, partnership, or joint venture:

_____

_____

_____

4. Bidder is authorized to do business in the State of Florida: ☐ Yes ☐ No

For how many years? _____

5. Your organization has been in business (under this firm's name) as a

_____

Is this firm in bankruptcy? _____

6. Attach a list of projects where this specific type of Work was performed.

BIDDER: _____

7. Is this firm currently contemplating or in litigation? Provide summary details.

_____

_____

_____

8. Have you ever been assessed liquidated damages under a contract during the past five (5) years? If so, state when, where (contact name, address and phone number) and why.

_____

_____

_____

9. Have you ever failed to complete Work awarded to you? Or failed to complete projects within contract time? If so, state when, where (contact name, address, phone number) and why.

_____

_____

_____

10. Have you ever been debarred or prohibited from providing a bid to a governmental entity? If yes, name the entity and describe the circumstances.

_____

_____

_____

11. Will you subcontract any part of this Work? If so, describe which portion(s) and to whom.

_____

_____

_____

12. If any part of work will be subcontracted, list MBE/DBE/WBE/VETERAN to be utilized. Include the estimated dollar amount of the portion of Work each will perform.

_____

_____

_____

BIDDER: _____

13. What equipment do you own to accomplish this Work? (A listing may be attached)

_____

_____

14. What equipment will you purchase/rent for the Work? (Specify which)

_____

_____

15. If applicable to the Work for this IFBC, Drilling Supervisor Qualifications: Contractor shall provide a boring specialist who shall remain on the project site during the entirety of the directional boring operation. This includes, but is not limited to, drilling fluid preparation, seaming, boring and pulling. The boring specialist shall have a minimum of five (5) years' experience in supervising directional bores of similar nature, diameter, materials and lengths. (Reference: Specification Section 02619, Horizontal Directional Drilling).

Provide the contact information for a minimum of three (3) projects wherein the boring specialist has performed this type of work, diameter, materials and lengths.

Boring specialist's name: _____
Boring specialist's years of experience in supervising directional bores _____
Provide contact name, and contact number for projects:

_____

_____

_____

16. If applicable to the Work for this IFBC, Pipe Fusion Qualifications: All boring and fusing equipment shall be certified for operation. The Contractor responsible for thermal butt fusing pipe and fittings shall have manufacturer certification for performing such work or a minimum of five (5) years of experience performing this type of work.

Thermal butt fusing pipe and fittings contractor or subcontractor's name: _____
Attach a copy of contractor's/subcontractor's manufacturer certification to this Questionnaire
OR
Provide contractor's/subcontractor's years of experience in thermal butt fusing pipe and fittings

_____
If manufacturer certification is not provided, include contact name, and contact number for projects that confirms five years of experience:

_____

_____

BIDDER: _____

17. If applicable to the Work for this IFB, Pipe Bursting Qualifications: The Contractor shall be certified by the manufacturer of the pipe bursting system that they are fully trained licensed installer of the manufacturer's pipe bursting system. Contractor shall provide a letter to the County documenting this requirement. (Reference: Specification Section 02619A, Pipe Bursting (PB) of Existing Mains).

18. List the following regarding the surety which is providing the bond(s):

Surety's Name: _____

Address: _____

_____

Name, address, phone number and email of surety's resident agent for service of process in Florida:

Agent's Name: _____

Address: _____

_____

Phone: _____

Email: _____

19. Is Bidder a local business as defined in Section A.38, Local Preference?

☐ Yes ☐ No

If yes, by signing below Bidder certifies that for at least six months prior to the advertisement date of this IFB it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota counties with at least one full-time employee at that location.

BIDDER: _____

BY: _____

PRINTED NAME: _____

TITLE/DATE: _____

PHYSICAL ADDRESS OF QUALIFYING LOCAL LOCATION: _____

_____

NAME OF QUALIFYING EMPLOYEE AT LOCAL LOCATION: _____

20. Confirm if Bidder has an environmental sustainability initiative as defined in Section A.41.

☐ Yes ☐ No

If yes, submit a brief summary (2-3 paragraphs) of the environmental sustainability initiative.

BIDDER: _____

APPENDIX C, ENVIRONMENTAL CRIMES CERTIFICATION

IFBC No. 22-TA004368SAM

SWORN STATEMENT PURSUANT TO ARTICLE V, MANATEE COUNTY PROCUREMENT CODE

Bidder must fully complete and return this form with its Bid. This form must be signed and sworn to in the presence of a notary public or other official authorized to administer oaths.

This sworn statement is submitted to the Manatee County Board of County Commissioners by

_____

[Print individual's name and title]

for _____ [Print name of entity submitting sworn statement]

whose business address is _____

and (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: _____.

I understand that no person or entity shall be awarded or receive an Owner's Agreement for public improvements, procurement of goods or services (including professional services) or an Owner's lease, franchise, concession or management agreement, or shall receive a grant of Owner's monies unless such person or entity has submitted a written certification to Owner that it has not:

(1) been convicted of bribery or attempting to bribe a public officer or employee of Manatee County, the State of Florida, or any other public entity, including, but not limited to the Government of the United States, any state, or any local government authority in the United States, in that officer's or employee's official capacity; or

(2) been convicted of an agreement or collusion among bidders or prospective bidders in restraint of freedom of competition, by agreement to bid a fixed price, or otherwise; or

(3) been convicted of a violation of an environmental law that, in the sole opinion of Owner's Purchasing Official, reflects negatively upon the ability of the person or entity to conduct business in a responsible manner; or

(4) made an admission of guilt of such conduct described in items (1), (2) or (3) above, which is a matter of record, but has not been prosecuted for such conduct, or has made an admission of guilt of such conduct, which is a matter of record, pursuant to formal prosecution. An admission of guilt shall be construed to include a plea of nolo contendere; or

(5) where an officer, official, agent or employee of a business entity has been convicted of or has admitted guilt to any of the crimes set forth above on behalf of such an entity and pursuant to the direction or authorization of an official thereof (including the person committing the offense, if he is an official of the business entity), the business shall be chargeable with the conduct herein above set forth. A business entity shall be chargeable with the conduct of an affiliated entity, whether wholly owned, partially owned, or one which has common ownership or a common Board of Directors. For purposes of this Form, business entities are affiliated if, directly or indirectly, one business entity controls or has the power to control another business entity, or if an individual or group of individuals controls or has the power to control both entities. Indicia of control shall include, without limitation, interlocking management or ownership, identity of interests among family members, shared organization of a business entity following the ineligibility of a business entity under this Article, or using substantially the same management, ownership or principles as the ineligible entity.
(Continued)

Any person or entity who claims that this Article is inapplicable to him/her/it because a conviction or judgment has been reversed by a court of competent jurisdiction shall prove the same with documentation satisfactory to Owner's Purchasing Official. Upon presentation of such satisfactory proof, the person or entity shall be allowed to contract with Owner.

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR MANATEE COUNTY IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT ANY AGREEMENT OR BUSINESS TRANSACTION SHALL PROVIDE FOR SUSPENSION OF PAYMENTS, OR TERMINATION, OR BOTH, IF THE CONTRACTING OFFICER OR COUNTY ADMINISTRATOR DETERMINES THAT **SUCH** PERSON OR ENTITY HAS MADE FALSE CERTIFICATION.

_____

[Signature]

STATE OF _____
COUNTY OF _____

Sworn to and subscribed before me this _ day of _____,20_____
by _____

Who is personally known / has produced _____ as identification

[Type of identification]

My commission expires _____

_____
Notary Public Signature

_____
[Print, type or stamp Commissioned name of Notary Public]

Signatory Requirement - In the case of a business entity other than a partnership or a corporation, this affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, this affidavit shall be executed by the general partner(s). In the case of a corporation, this affidavit shall be executed by the corporate president.

APPENDIX D, FLORIDA TRENCH SAFETY ACT

Bidder must fully complete and return this form with its Bid. This form must be singed in the presence of a notary public or by an officer authorized to administer oaths.

1. This Sworn Statement is submitted with **IFBC NO. 22-TA004368SAM**
2. This Sworn Statement is submitted by_____ whose business address is_____ and, 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 _____.
3. Name of individual signing this Sworn Statement is: _____, Whose relationship to the above entity is: _____.
4. The Trench Safety Standards that will be in effect during the construction of this project shall include, but are not limited to: Laws of Florida, Chapters 90-96, TRENCH SAFETY ACT, and OSHA RULES AND REGULATIONS 29 CFR 1926.650 Subpart P, effective October 1, 1990.
5. The undersigned assures that the entity will comply with the applicable Trench Safety Standards and agrees to indemnify and hold harmless the County and Engineer of Record, and any of their agents or employees from any claims arising from the failure to comply with said standard.
6. The undersigned has appropriated the following costs for compliance with the applicable standards:

Trench Safety Measure (Description)	Units of Measure (LF, SY)	Unit Quantity	Unit Cost	Extended Cost
a. _____	_____	_____	$_____	_____
b. _____	_____	_____	$_____	_____
c. _____	_____	_____	$_____	_____
d. _____	_____	_____	$_____	_____

7. The undersigned intends to comply with these standards by instituting the following procedures:
_____
_____
_____

THE UNDERSIGNED, in submitting this bid, represents that they have reviewed and considered all available geotechnical information and made such other investigations and tests as they may deem necessary to adequately design the trench safety system(s) to be utilized on this project.

_____
(Authorized signature / Title)

SWORN to and subscribed before me this _____ day of _____, 20_____.
(Impress official seal)

Notary Public, State of _____: _____

My commission expires: _____

Angelina M. Colonneso
CLERK OF THE CIRCUIT COURT AND COMPTROLLER OF MANATEE COUNTY
1115 Manatee Avenue West, Bradenton, Florida 34205 - Phone (941) 749-1800 Fax (941) 741-4082, P.O. Box 25400, Bradenton, Florida 34206 - www.manateeclerk.com

Bidder must fully complete and return this form with its Bid.

APPENDIX E: ePAYABLES APPLICATION

Company name_____

Contact person_____

Phone number_____

Email Address_____

FINANCE USE ONLY

Open orders: YES or NO

PEID _____

CREATE DATE _____

CONFIRMED WITH

_____

_

Name and phone number

IFAS _____

BANK _____

INITIALS_____

Return completed form Via email to:
tina.mancini@manateeclerk.com
Via fax to: (941) 741-4011
Via mail:
PO Box 1000
Bradenton, Fl 34206

Revised: September 30, 2015

"Pride in Service with a Vision to the Future"
Clerk of the Circuit Court – Clerk of Board of County Commissioners – County Comptroller – Auditor and Recorder

APPENDIX F, SCRUTINIZED COMPANY CERTIFICATION
IFBC No. 22-TA004368SAM

This certification is required pursuant to Florida State Statute Section 287.135.

As of July 1, 2011, a company that, at the time of bidding or submitting a proposal for a new contract or renewal of an existing contract, is on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with an agency or local governmental entity for goods or services of $1 million or more.

Bidder must fully complete and return this form with its Bid.

Company _____ FID or EIN No. _____

Address
_____

City _____ State _____ Zip _____

I, _____, as a representative of _____ certify and affirm that this company is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List.

_____ _____
Signature Title

_____ _____
Printed Name Date

APPENDIX G, MANATEE COUNTY, A POLITICAL SUBDIVISION OF THE STATE OF FLORIDA INDEMNITY AND HOLD HARMLESS

IFBC No. 22-TA004368SAM

Bidder must fully complete and return this form with its Bid.

Bidder shall defend, indemnify and hold harmless the County and all of the County's officers, agents, employees, and volunteers from and against all claims, liability, loss and expense, including reasonable costs, collection expenses, attorneys' fees, and court costs which may arise because of the negligence (whether active or passive), misconduct, or other fault, in whole or in part (whether joint, concurrent, or contributing), of Respondent, its officers, employees, representatives and agents in performance or non-performance of its obligations under the Contract/Agreement. Bidder recognizes the broad nature of this indemnification and hold harmless clause, as well as the provision of a legal defense to the County when necessary, and voluntarily makes this covenant and expressly acknowledges the receipt of such good and valuable consideration provided by the County in support of these indemnification, legal defense and hold harmless contractual obligations in accordance with the laws of the State of Florida. This clause shall survive the termination of this Contract/Agreement. Compliance with any insurance requirements required elsewhere within this Contract/Agreement shall not relieve Bidder of its liability and obligation to defend, hold harmless and indemnify the County as set forth in this article of the Contract/Agreement.

Nothing herein shall be construed to extend the County's liability beyond that provided in section 768.28, Florida Statutes.

PROJECT NUMBER AND/OR NAME	
INSURANCE AGENT	
RESPONDENT SIGNATURE	**DATE**

Acknowledgement:

STATE OF _____ COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____,

20____ by _____ [FULL LEGAL NAME], who is

personally known to me / has produced _____ as identification.

Notary Signature _____

Print Name _____

APPENDIX H, INSURANCE STATEMENT

IFBC No. 22-TA004368SAM

Bidder must fully complete and return this form with its Bid.

THE UNDERSIGNED has read and understands the insurance requirements of this IFBC applicable to any contract resulting from this solicitation and shall provide the insurances required by this Appendix within ten (10) days from the date of Notice of Intent to Award.

Bidder Name: _____ Date: _____

Signature (Authorized Official): _____

Printed Name/Title: _____

Insurance Agency: _____

Agent Name: _____ Agent Phone: _____

APPENDIX I, ACKNOWLEDGMENT OF ADDENDA
IFBC No. 22-TA004368SAM

The undersigned acknowledges receipt of the following addenda:

Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:

Print or type Bidder's information below:

Name of Bidder | Telephone Number

Street Address | City/State/Zip

Email Address

Print Name & Title of Authorized Officer | Signature of Authorized Official Date

APPENDIX J, AFFIDAVIT OF NO CONFLICT

IFBC No. 22-TA004368SAM

COUNTY OF _____
STATE OF _____

BEFORE ME, the undersigned authority, this _____ day of _____, 20____ personally appeared, _____, a principal with full authority to bind _____ (hereinafter the "Affiant"), who being first duly sworn, deposes and says:

(a) is not currently engaged or will not become engaged in any obligations, undertakings or contracts that will require the Affiant to maintain an adversarial role against the County or that will impair or influence the advice, recommendations or quality of work provided to the County; and

(b) has provided full disclosure of all potentially conflicting contractual relationships and full disclosure of contractual relationships deemed to raise a question of conflict(s); and

(c) has provided full disclosure of prior work history and qualifications that may be deemed to raise possible question of conflict(s).

Affiant makes this affidavit for the purpose of inducing Manatee County, a political subdivision of the State of Florida, to enter into an Agreement for Master Lift Station N1-B Rehabilitation.

If applicable, on a separate page Bidder shall disclose the name of any officer, director or agent of Bidder who is also an employee of the County and the name of any County employee who owns, directly or indirectly, any interest in the Bidder's firm or any of its branches. If no conflicts of interest are present, submit a statement to that affect.

_____
Signature

_____
Print Name

SUBSCRIBED to and sworn before me this _____ day of _____, 20__.

[Notary Seal]

Notary Public

My commission expires: _____

_____
Notary Signature

_____
Print Name

Personally known OR produced identification. Type of identification produced _____

_____.

APPENDIX K, BID PRICING FORM

IFBC No.22-TA004968SAM, Master Lift Station N1-B Rehabilitation

Total Bid Price/Offer for Bid 'A': $_____Complete. Base on a completion time of 270 calendar days.

Total Bid Price/Offer for Bid 'B': $_____Complete. Based on a completion time of 230 calendar days.

We, the undersigned, hereby declare that we have carefully reviewed the IFBC Documents in their entirety and with full knowledge and understanding of the Bid information and all its requirements, submit this Bid, which is complete in meeting each specification, term, and condition contained therein.

As Bidder, we understand that the IFBC documents, including but not limited to, all specifications, terms, and conditions shall be made a part of any resulting Agreement between County and the successful Bidder. Failure by successful Bidder to comply with such specifications, terms and conditions shall result in Agreement default, whereupon, the defaulting successful Bidder shall be required to pay for all re-procurement costs, damages, and attorney fees as incurred by County, and agrees to forfeit its bid bond.

Authorized Signature(s): _____

Name and Title of Above Signer(s):

_____

Date: _____

APPENDIX K, BID PRICING FORM
IFBC NO. 22-TA004368SAM
MASTER LIFT STATION N1-B REHABILITATION
BID FORM 'A' BASED ON 270 CALENDAR DAYS COMPLETION

Bidders must provide prices for each line item for their bid to be considered responsive.

Pay Item No.	Description	Unit	Qty	Unit Price($)	Total Amount ($)
1	Mobilization, Demobilization and Site Work	LS	1		
2	Demolition	LS	1		
3	Pumps, Valves and Appurtenances	LS	1		
4	Magnetic Flow Meter and Site Piping	LS	1		
5	Pre-Engineered Concrete Building	LS	1		
6	Temporary Bypass Pumping	LS	1		
7	Comminutor	LS	1		
8	Electrical, Instrumentation and Control Improvements	LS	1		
9	Wetwell Cleaning	LS	1		
10	Wetwell Existing Coating Removal	SF	1,000		
11	Wetwell Existing Coating Removal	SF	1,000		
12	Wetwell Rehab - Concrete Repair Up to 3.0" Depth	SF	400		
	Wetwell Rehab - Concrete Repair 3.1" - 6.0" Depth	SF	200		
	Wetwell Rehab - Concrete Repair 6.1" - 9.0" Depth	SF	200		
	Wetwell Rehab - Concrete Repair 9.1" - 12.0" Depth	SF	200		
	Wetwell Rehab - Rebar Repair Including Remove and Replace	LF	100		
SUBTOTAL PRICE (Total of items No. 1-12)					
CONSTRUCTION CONTINGENCY COUNTY AUTHORIZED USE ONLY (10% of Subtotal Price)					
Allowance for permits and fees issued by Manatee County Government					$ 5,000.00
TOTAL BID PRICE (Subtotal Price plus the Construction Contingency and Allowance)					

Bidder: _____

Signature:_____

APPENDIX K, BID PRICING FORM
IFBC NO. 22-TA004368SAM
MASTER LIFT STATION N1-B REHABILITATION
BID FORM 'B' BASED ON 230 CALENDAR DAYS COMPLETION

Bidders must provide prices for each line item for their bid to be considered responsive.

Pay Item No.	Description	Unit	Qty	Unit Price($)	Total Amount ($)
1	Mobilization, Demobilization and Site Work	LS	1		
2	Demolition	LS	1		
3	Pumps, Valves and Appurtenances	LS	1		
4	Magnetic Flow Meter and Site Piping	LS	1		
5	Pre-Engineered Concrete Building	LS	1		
6	Temporary Bypass Pumping	LS	1		
7	Comminutor	LS	1		
8	Electrical, Instrumentation and Control Improvements	LS	1		
9	Wetwell Cleaning	LS	1		
10	Wetwell Existing Coating Removal	SF	1,000		
11	Wetwell Existing Coating Removal	SF	1,000		
12	Wetwell Rehab - Concrete Repair Up to 3.0" Depth	SF	400		
	Wetwell Rehab - Concrete Repair 3.1" - 6.0" Depth	SF	200		
	Wetwell Rehab - Concrete Repair 6.1" - 9.0" Depth	SF	200		
	Wetwell Rehab - Concrete Repair 9.1" - 12.0" Depth	SF	200		
	Wetwell Rehab - Rebar Repair Including Remove and Replace	LF	100		
SUBTOTAL PRICE (Total of items No. 1-12)					
CONSTRUCTION CONTINGENCY COUNTY AUTHORIZED USE ONLY (10% of Subtotal Price)					
Allowance for permits and fees issued by Manatee County Government					$ 5,000.00
TOTAL BID PRICE (Subtotal Price plus the Construction Contingency and Allowance)					

Bidder:_____

Signature:_____

SECTION C, BID ATTACHMENTS

BID ATTACHMENT 1, INSURANCE AND BOND REQUIREMENTS

The CONTRACTOR will not commence work under the resulting Agreement until all insurance coverages indicated by an "X" herein have been obtained. The CONTRACTOR shall obtain and submit to the Procurement Division within ten (10) calendar days from the date of notice of intent to award, at its expense, the following minimum amounts of insurance (inclusive of any amounts provided by an umbrella or excess policy): Work under this Agreement cannot commence until all insurance coverages indicated herein have been obtained on a standard ACORD form (inclusive of any amounts provided by an umbrella or excess policy):

☒ **Automobile Liability Insurance Required Limits**

Coverage must be afforded under a per occurrence policy form including coverage for all owned, hired and non-owned vehicles for bodily injury and property damage of not less than:

- $2,000,000 Combined Single Limit; OR
- $1,000,000 Bodily Injury and $1,000,000 Property Damage
- $10,000 Personal Injury Protection (No Fault)
- $500,000 Hired, Non-Owned Liability
- $10,000 Medical Payments

This policy shall contain severability of interests' provisions.

☒ **Commercial General Liability Insurance Required Limits (per Occurrence form only; claims-made form is not acceptable)**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County, a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $2,000,000 Single Limit Per Occurrence
- $4,000,000 Aggregate
- $2,000,000 Products/Completed Operations Aggregate
- $1,000,000 Personal and Advertising Injury Liability
- $100,000 Fire Damage Liability
- $10,000 Medical Expense, and
- $1,000,000, Third Party Property Damage
- $ Project Specific Aggregate (Required on projects valued at over $10,000,000)

This policy shall contain severability of interests' provisions.

☒ **Employer's Liability Insurance**

Coverage limits of not less than:

- $100,000 Each Accident
- $500,000 Disease Each Employee
- $100,000 Disease Policy Limit

☒ **Worker's Compensation Insurance**
☐ **US Longshoremen & Harbor Workers Act**
☐ **Jones Act Coverage**

Coverage limits of not less than:

- Statutory workers' compensation coverage shall apply for all employees in compliance with the laws and statutes of the State of Florida and the federal government.
- If any operations are to be undertaken on or about navigable waters, coverage must be included for the US Longshoremen & Harbor Workers Act and Jones Act.

Should 'leased employees' be retained for any part of the project or service, the employee leasing agency shall provide evidence of Workers' Compensation coverage and Employer's Liability coverage for all personnel on the worksite and in compliance with the above Workers' Compensation requirements. NOTE: Workers' Compensation coverage is a firm requirement. Elective exemptions are considered on a case-by-case basis and are approved in a very limited number of instances.

☐ **Aircraft Liability Insurance Required Limits**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Each Occurrence Property and Bodily Injury with no less than $100,000 per passenger each occurrence or a 'smooth' limit.
- $ General Aggregate.

☐ **Un-Manned Aircraft Liability Insurance (Drone)**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Each Occurrence Property and Bodily Injury; Coverage shall specifically include operation of Unmanned Aircraft Systems (UAS), including liability and property damage.
- $ General Aggregate

☐ **Installation Floater Insurance**
When the contract or agreement **does not** include construction of, or additions to, above ground building or structures, but does involve the installation of machinery or equipment, Installation Floater Insurance shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- 100% of the completed value of such addition(s), building(s), or structure(s)

☐ **Professional Liability and/or Errors and Omissions (E&O) Liability Insurances**
Coverage shall be afforded under either an occurrence policy form or a claims-made policy form. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

- $ 1,000,000 Bodily Injury and Property Damage Each Occurrence
- $ 2,000,000 General Aggregate

☒ **Builder's Risk Insurance**
When the contract or agreement includes the construction of roadways and/or the addition of a permanent structure or building, including the installation of machinery and/or equipment, Builder's Risk Insurance shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- An amount equal to 100% of the completed value of the project, or the value of the equipment to be installed
- The policy shall not carry a self-insured retention/deductible greater than $10,000

Coverage shall be for all risks and include, but not be limited to, storage and transport of materials, equipment, supplies of any kind whatsoever to be used on or incidental to the project, theft coverage, and Waiver of Occupancy Clause Endorsement, where applicable.

☐ **Cyber Liability Insurance**
Coverage shall comply with Florida Statute 501.171, shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County, a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Security Breach Liability
- $ Security Breach Expense Each Occurrence
- $ Security Breach Expense Aggregate
- $ Replacement or Restoration of Electronic Data
- $ Extortion Threats
- $ Business Income and Extra Expense
- $ Public Relations Expense

NOTE: Policy must not carry a self-insured retention/deductible greater than $25,000.

☐ **Hazardous Materials Insurance (As Noted Below)**
Hazardous materials include all materials and substances that are currently designated or defined as hazardous by the law or rules of regulation by the State of Florida or federal government.
All coverage shall be afforded under either an occurrence policy form or a claims-made policy form, and the policy shall be endorsed and name 'Manatee County, a political subdivision of the

State of Florida' as an Additional Insured. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

☐ ***Pollution Liability***
Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Bodily Injury and Property Damage to include sudden and gradual release, each claim and aggregate.

☐ ***Asbestos Liability (If handling within scope of Contract)***
Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Bodily Injury and Property Damage to include sudden and gradual release, each claim and aggregate.

☐ ***Disposal***
When applicable, CONTRACTOR shall designate the disposal site and furnish a Certificate of Insurance from the disposal facility for Environmental Impairment Liability Insurance covering liability.

- Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Liability for Sudden and Accidental Occurrences, each claim and an aggregate.
- Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Liability for Non-Sudden and Accidental Occurrences, each claim and an aggregate.

☐ **Hazardous Waste Transportation Insurance**
CONTRACTOR shall designate the hauler and have the hauler furnish a Certificate of Insurance for Automobile Liability insurance with Endorsement MCS-90 for liability arising out of the transportation of hazardous materials. EPA identification number shall be provided.

All coverage shall be afforded under either an occurrence policy form or a claims-made policy form and the policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

- Amount equal to the value of the contract, subject to a $1,000,000 minimum, per accident.

☐ **Liquor Liability Insurance**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- $1,000,000 Each Occurrence and Aggregate

☐ **Garage Keeper's Liability Insurance**

Coverage shall be required if the maintenance, servicing, cleaning or repairing of any County motor vehicles is inherent or implied within the provision of the contract.

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- Property and asset coverage in the full replacement value of the lot or garage.

☐ **Bailee's Customer Liability Insurance**

Coverage shall be required for damage and/or destruction when County property is temporarily under the care or custody of a person or organization, including property that is on, or in transit to and from the person or organization's premises. Perils covered should include fire, lightning, theft, burglary, robbery, explosion, collision, flood, earthquake and damage or destruction during transportation by a carrier.

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- Property and asset coverage in the full replacement value of the County asset(s) in the CONTRACTOR'S care, custody and control.

☐ **Hull and Watercraft Liability Insurance**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- $ Each Occurrence
- $ General Aggregate
- $ Fire Damage Liability
- $10,000 Medical Expense, and
- $ Third Party Property Damage
- $ Project Specific Aggregate (Required on projects valued at over $10,000,000)

☐ **Other [Specify]**

BOND REQUIREMENTS

☒ **Bid Bond**

A Bid Bond in the amount of $_____ or 5% of the total offer. Bid bond shall be submitted with the sealed response and shall include project name, location, and / or address and project number. In lieu of the bond, the bidder may file an alternative form of security in the amount of $_____ or 5% of the total offer. in the form of a money order, a certified check, a cashier's check, or an irrevocable letter of credit issued to Manatee County. NOTE: A construction project over $200,000 requires a Bid Bond in the amount of 5% of the total bid offer.

☒ **Payment and Performance Bond**

A Payment and Performance Bond shall be submitted by Successful Bidder for 100% of the award amount and shall be presented to Manatee County within ten (10) calendar days of issuance of the notice of intent to award. NOTE: A construction project over $200,000 requires a Payment and Performance Bond.

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INSURANCE REQUIREMENTS

I. THE POLICIES BELOW ARE TO CONTAIN, OR BE ENDORSED TO CONTAIN, THE FOLLOWING PROVISIONS:

1. Commercial General Liability and Automobile Liability Coverages

a. **"Manatee County, a Political Subdivision of the State of Florida," is to be named as an Additional Insured in respect to:** Liability arising out of activities performed by or on behalf of the successful Bidder, his agents, representatives, and employees; products and completed operations of the successful Bidder; or automobiles owned, leased, hired or borrowed by the successful Bidder. The coverage shall contain no special limitation(s) on the scope of protection afforded to the County, its officials, employees or volunteers.

In addition to furnishing a Certificate of Insurance, the successful Bidder shall provide the endorsement that evidences Manatee County being listed as an Additional Insured. This can be done in one of two ways: (1) an endorsement can be issued that specifically lists "Manatee County, a Political Subdivision of the State of Florida," as Additional Insured; or, (2) an endorsement can be issued that states that all Certificate Holders are Additional Insured with respect to the policy.

b. The successful Bidder's insurance coverage shall be primary insurance with respect to the County, its officials, employees and volunteers. Any insurance or self-insurance maintained by the County, its officials, employees or volunteers shall be excess of successful Bidder's insurance and shall be non-contributory.

c. The insurance policies must be on an occurrence form.

2. Workers' Compensation and Employers' Liability Coverages

The insurer shall agree to waive all rights of subrogation against the County, its officials, employees and volunteers for losses arising from work performed by the successful Bidder for the County.

II. GENERAL INSURANCE PROVISIONS APPLICABLE TO ALL POLICIES:

1. Prior to the execution of contract, or issuance of a Purchase Order, and then annually upon the anniversary date(s) of the insurance policy's renewal date(s) for as long as this contract remains in effect, successful Bidder shall furnish the County with a Certificate(s) of Insurance (using an industry accepted certificate form, signed by the Issuer, with applicable endorsements, and containing the solicitation or contract number, and title or description) evidencing the coverage set forth above and naming "Manatee County, a Political Subdivision of the State of Florida" as an Additional Insured on the applicable coverage(s) set forth above.

2. If the policy contains an aggregate limit, confirmation is needed in writing (letter, email, etc.) that the aggregate limit has not been eroded to procurement representative when supplying Certificate of Insurance.

   In addition, when requested in writing from the County, successful Bidder will provide the County with a certified copy of all applicable policies. The address where such certificates and certified policies shall be sent or delivered is as follows:

   Manatee County, a Political Subdivision of the State of Florida
   Attn: Risk Management Division
   1112 Manatee Avenue West, Suite 969
   Bradenton, FL 34205

3. The project's solicitation number and title shall be listed on each certificate.

4. successful Bidder shall provide thirty (30) days written notice to the Risk Manager of any cancellation, non-renewal, termination, material change, or reduction in coverage of any insurance policies to procurement representative including solicitation number and title with all notices.

5. successful Bidder agrees that should at any time successful Bidder fail to meet or maintain the required insurance coverage(s) as set forth herein, the County may terminate this contract.

6. The successful Bidder waives all subrogation rights against Manatee County, a Political Subdivision of the State of Florida, for all losses or damages which occur during the contract and for any events occurring during the contract period, whether the suit is brought during the contract period or not.

7. The successful Bidder has sole responsibility for all insurance premiums and policy deductibles.

8. It is the successful Bidder's responsibility to ensure that his agents, representatives and subcontractors comply with the insurance requirements set forth herein. successful Bidder shall include his agents, representatives, and subcontractors working on the project or at the worksite as insured under its policies, or successful Bidder shall furnish separate certificates and endorsements for each agent, representative, and subcontractor working on the project or at the worksite. All coverages for agents, representatives, and subcontractors shall be subject to all of the requirements set forth to the procurement representative.

9. All required insurance policies must be written with a carrier having a minimum A.M. Best rating of A- FSC VII or better. In addition, the County has the right to review the successful Bidder's deductible or self-insured retention and to require that it be reduced or eliminated.

III. Successful Bidder understands and agrees that the stipulated limits of coverage listed herein in this insurance section shall not be construed as a limitation of any potential liability to the County, or to others, and the County's failure to request evidence of this insurance coverage shall not be construed as a waiver of successful Bidder's obligation to provide and maintain the insurance coverage specified.

IV. The enclosed Hold Harmless Agreement shall be signed by the successful Bidder and shall become a part of the contract.

V. Successful Bidder understands and agrees that the County does not waive its immunity, and nothing herein shall be interpreted as a waiver of the County's rights, including the limitation of waiver of immunity, as set forth in Florida Statutes 768.28, or any other statutes, and the County expressly reserves these rights to the full extent allowed by law.

VI. No award shall be made until the Procurement Division has received the Certificate of Insurance and Hold Harmless Agreement in accordance with this section.

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BID ATTACHMENT 2, TECHNICAL SPECIFICATIONS

MLS N1-B REHABILITATION

BID DESIGN
TECHNICAL SPECIFICATIONS
AUGUST 2022

PREPARED FOR
BOARD OF COUNTY COMMISSIONERS
COUNTY OF MANATEE, FLORIDA
MANATEE COUNTY PROJECT NO:
6022388 / 6022389

PREPARED BY

BROWN AND CALDWELL

PROJECT NO: 156470

MANATEE COUNTY

MLS N1-B REHABILITATION

VOLUME 1 OF 2

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This specification includes by reference the Manatee County Public Works Standards, Part I Utilities Standards Manual approved February 25, 2020.

All items and/or materials furnished and installed shall conform to the Manatee County Approved Products List. All items listed in the submittal requirements under each section shall be required to be submitted for review and/or acceptance.

SECTION 01005 GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description

The work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract.

B. Work Included

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work.. He shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the County, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all incidental costs. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made.

The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment.

C. Public Utility Installations and Structures

Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto.

The Contractor shall protect all installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the County. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor, which are shown on the Plans or have been located in the field by the utility, shall be repaired by the Contractor, at his expense, as approved by the County. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the County or other governmental body, which are required by this contract to be removed, relocated, replaced or rebuilt by the Contractor not identified in any separate bid item shall be considered as a part of the general cost of doing the work and shall be included in the prices bid for the various contract items. No separate payment shall be made.

Where public utility installations or structures owned or controlled by the County or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the County, for the contractor to accomplish. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be in accordance with the General and Supplemental General Conditions.

The Contractor shall give written notice to County and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Sunshine State One-Call of Florida, Inc. Call Center ("Call Sunshine") and per all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the County.

1.02 PLANS AND SPECIFICATIONS

A. Plans

When obtaining data and information from the Plans, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.

B. Copies Furnished to Contractor

The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the County, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the County and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data

The Contractor shall verify all dimensions, quantities and details shown on the Plans, Supplementary Drawings, Schedules, Specifications or other data received from the County, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting therefrom nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be

furnished by the County, should such errors or omissions be discovered. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications

The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the County, that the manufacturer or subcontractor deal directly with the County. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery

The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories

The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

Spare parts shall be furnished as specified.

Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

D. Installation of Equipment.

The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character.

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the County during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the County and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

The Contractor shall furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M or provide a 1/32-inch neoprene gasket between the metal surface and the concrete or grout.

E. Service of Manufacturer's Engineer

The Contract prices for equipment shall include the cost of furnishing (as required by equipment specifications sections) a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the County, such engineer or superintendent shall make all adjustments and tests required by the County to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the County in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

Inspection and testing of materials will be performed by the County unless otherwise specified.

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Three (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the County as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the County that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the County.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the County formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the County or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the County for compliance. The Contractor shall reimburse the County for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Inspections of Materials

The Contractor shall give notice in writing to the County, at least two weeks in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture of preparation of materials. Upon receipt of such notice, the County will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture

When inspection is waived or when the County so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Shop Tests of Operating Equipment

Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the work until the County notifies the Contractor, in writing, that the results of such tests are acceptable.

The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Preliminary Field Tests

As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests

Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the County. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor. The decision of the County as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the County, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

In case the County rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the County may, after the expiration of a period of thirty (30) calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under his Contract.

I. Final Inspection

During such final inspections, the work shall be clean and free from water. In no case will the final pay application be prepared until the Contractor has complied with all requirements set forth and the County has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Document.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the County, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The County shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 TEMPORARY SERVICES

A. First Aid

The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the work.

1.07 LINES AND GRADES

A. Grade

All work under this Contract shall be constructed in accordance with the lines and grades shown on the Plans, or as given by the County. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum of the NAVD 1988 and/or NGVD 1929.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Plans, and the removal, relocation and reconstruction of such items called for on the Plans or specified shall be included in the various Contract Items and no separate payments will be made therefore. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Plans and when, in the opinion of the County, additional work is deemed necessary to avoid interference with the work, payment therefore will be made as provided for in the General Conditions.

Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.

Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the County. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the County.

Prior to the beginning of any excavations, the Contractor shall advise the County of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.
2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.
3. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. If so ordered, the County will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

C. Lawn Areas

Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod.

D. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the County. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public, in accordance with state and local requirements.

B. Smoke Prevention

A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise

The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all engines or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

D. Access to Public Services

Neither the materials excavated nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

E. Dust prevention

The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the County and in accordance with the Plans and Specifications. The work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction

During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable. The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning

At the conclusion of the work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.12 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the County which results from his construction operations.

B. Protection of Wetland Areas

The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or Southwest Florida Water Management District.

C. Existing Facilities

The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

D. Use of Chemicals

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01010 SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. This Project, Master Lift Station (MLS) N1-B Rehabilitation, consists of work at the MLS N1-B pump station as identified here:

MLS N-1B is located at 2903 69th Court, Palmetto, FL 34221. In general the lift station includes a lift station building, dry-pit pumps, variable frequency drives (VFDs), strap-on flow meter, a generator, and multiple electrical elements. Due to aging equipment and decreased future flow demands at MLS N-1B the COUNTY determined a rehabilitation project was appropriate.

MLS N-1B Summary of Work

The work included in this contract consists of the rehabilitation of the Master Lift Station (MLS) N1-B. This involves, but not limited to:

a. Furnishing and installing pump replacement of the current dry-pit pumps, motors and variable frequency drives (VFDs).
b. Furnishing and installation of an above ground magnetic flow meter on a concrete pad, with associative piping, pipe supports, valving, and other required appurtenance.
c. Furnishing and installation a replacement comminutor and control panel.
d. Dewatering and cleaning the wet wells.
e. Coating repair, as directed by the coating vendor and County Staff for required repairs of the existing coating system. If it is deemed unrepairable, complete coating replacement is a bid additive item.
f. Furnishing and installing a precast concrete building, which will house electrical equipment and variable frequency drive. The precast metal building includes an HVAC system, foundation, and other integral systems.
g. Demolition and removal of all existing electrical distribution equipment to meet updated NFPA 820 requirements. Equipment being demolished include serv ice main/generator breaker section, switchboard section, motor control center lineup, automatic transfer switch, and existing lighting panel with transformer. The VFD isolation transformer will be demolished and removed as well.
h. The existing control panel remote terminal unit (RTU) 90 will be relocated.
i. Site work is required, which includes grading, sidewalk, striping and undercutting soil, foundation preparation, demolition of existing concrete pad, open-cut trenching of new force main, and temporary erosion and sediment control.
j. The project requires temporary bypass pumping for continuous operations.

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the County.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

E. Work hours shall be limited to 7:00 AM thru 5:00 PM Monday thru Friday. No work shall be performed on County Staff holidays.

1.02 CONTRACTS

Construct all the Work under a single contract.

1.03 WORK SEQUENCE

A. All work done under this Contract shall be done with a minimum of inconvenience to the users of the system or facility. The Contractor shall coordinate his work with private property owners such that existing utility services are maintained to all users to the maximum extent possible.

B. The Contractor shall, if necessary and feasible, construct the work in stages to accommodate the County's use of the premises during the construction period; coordinate the construction schedule and operations with the County's Representative.

C. The Contractor shall, where feasible, construct the Work in stages to provide for public convenience and not close off public use of any facility until completion of construction to provide alternative usage.

1.04 CONSTRUCTION AREAS

A. The Contractor shall: Limit his use of the construction areas for work and for storage, to allow for:

1. Work by other Contractors.
2. County's Use.
3. Public Use.

B. Coordinate use of work site under direction of County's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored products under the Contractor's control, which interfere with operations of the County or separate contractor.

E. Obtain and pay for the use of additional storage of work areas needed for Contractor operations.

1.05 COUNTY OCCUPANCY

A. It is assumed that portions of the Work will be completed prior to completion of the entire Work. Upon completion of construction of each individual facility, including testing, if the County, at its sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The County will assume ownership and begin operation of the individual facility on that date and the three-year guaranty period shall commence on that date. The County has the option of not accepting the entire work as a whole until it is completed, tested and approved by the County.

1.06 PARTIAL COUNTY OCCUPANCY

The Contractor shall schedule his operations for completion of portions of the Work, as designated, for the County's occupancy prior to substantial completion of the entire work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01015 CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the County to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the County to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

The Contractor shall not enter or occupy private land outside of easements, except by permission of the affected property owner.

1.03 WORK LOCATIONS

Work shall be located substantially as indicated on the drawings, but the County reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be barricaded and well lighted at all times when construction is not in progress.

1.05 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall avoid interruptions to water, telephone, cable TV, sewer, gas, or other related utility services. He shall notify the County and the appropriate agency well in advance of any requirement for dewatering, isolating, or relocating a section of a utility, so that necessary arrangements may be made.

B. If it appears that utility service will be interrupted for an extended period, the County may order the Contractor to provide temporary service lines at the Contractor's expense.

Inconvenience of the users shall be kept to the minimum, consistent with existing conditions. The safety and integrity of the systems are of prime importance in scheduling work.

1.06 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to building utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables and other similar facilities, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operation shall be repaired by the Contractor at his expense.

B. The Contractor shall bear full responsibility for obtaining locations of all underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit prices established in the Bid.

D. If, in the opinion of the County, permanent relocation of a utility owned by the County is required, the County may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work as classified in the General Conditions. If relocation of a privately owned utility is required, the County will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the County and utility and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays and legal holidays) before excavating near their utilities.

1.07 TEST PITS

Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor immediately after the utility location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.08 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the County.

B. All sidewalks which are disturbed by the Contractor's operations shall be restored to their original or better condition by the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best modern practice.

C. Along the location of this work, all fences, walks, bushes, trees, shrubbery and other

physical features shall be protected and restored in a thoroughly workmanlike manner unless otherwise shown on the drawings. Fences and other features removed by the Contractor shall be replaced in the location indicated by the County as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

D. Trees close to the work which drawings do not specify to be removed, shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification to the County. All injuries to bark, trunk, limbs and roots of trees shall be repaired by dressing, cutting and painting according to approved methods, using only approved tools and materials.

E. The protection, removal and replacement of existing physical features along the line of work shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Bid.

1.09 MAINTENANCE OF TRAFFIC

A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage. Extended stoppage will be defined by the County.

B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other safety measures which are satisfactory to the County.

1.10 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The Contractor shall be responsible for paying for all water tap fees incurred for the purpose of obtaining a potable water service or temporary use meter.

1.11 MAINTENANCE OF FLOW

The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the County well in advance of the interruption of any flow.

1.12 CLEANUP

During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the

work in a neat and orderly condition.

1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the County.

1.14 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.

B. All structures shall be protected in a manner approved by the County. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the County. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the County.

1.15 CONSTRUCTION WITHIN RIGHT-OF-WAY (NOTE USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01030 SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the County to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the County. The costs for obtaining all permits shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the existing systems all as shown on the Drawings or where directed by the County. The cost for this work and for the actual connection shall be included in the price bid for the project and shall not result in any additional cost to the County. The termination point for each contract shall be as shown on the Contract Drawings.

1.03 RELOCATIONS

The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the County.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice.

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the County and shall provide suggestions on how best to resolve the issue.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County.

F. It is intended that wherever existing utilities such as water, sewer, gas, telephone, electrical, or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the County this procedure is not feasible, he may direct the use of fittings for a utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.05 SUSPENSION OF WORK DUE TO WEATHER

Refer to FDOT Standards and Specifications Book, Section 8.

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the County a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the County in case of a hurricane warning.

B. In the event of inclement weather, or whenever County shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the County, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.08 SALVAGE

Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the County and if so shall be protected for a reasonable time until picked up by the County. Any equipment or material not worthy of salvaging, as directed by the County, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

A. The Contractor shall do all groundwater pumping necessary to prevent flotation of any part of the work during construction operations with his own equipment.

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water in an appropriate manner.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the County, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The County's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the County.

1.11 CONSTRUCTION CONDITIONS

The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) and/or agency(ies) having jurisdiction over the work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the County for excessive noise shall not relieve the Contractor of the other portions of this specification.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a period of three (3) years. Warranty period shall commence on the date of County acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the County. All material and installation costs shall be 100% borne by the Contractor.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications,

D. In the event that the manufacturer is unwilling to provide a three-year warranty commencing at the time of County acceptance, the Contractor shall obtain from the manufacturer a four (4) year warranty starting at the time of equipment delivery to the job site. This four-year

warranty shall not relieve the Contractor of the three-year warranty starting at the time of County acceptance of the equipment.

1.14 FUEL STORAGE & FILLING

A. If the contractor is storing fuel on site, or doing his own fuel filling of portable equipment (other than hand-held equipment), he is responsible for any required response, clean-up or reporting required, at no additional cost to the county.

B. The Contractor shall prepare and submit a fuel storage / spill abatement plan prior to start of construction if required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01040 COORDINATION WITH COUNTY'S OPERATIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. At no time shall forward flow into the MLS N1-B be required to be stopped to perform the Work. The Contractor shall be responsible for maintenance of flows of MLS N1-B at all times during construction.

B. Contractor's means and methods shall be implemented such that the existing lift station shall remain in continuous satisfactory operation during the entire construction period except as absolutely required for the work. Work shall be so scheduled and conducted by Contractor such that it shall not reduce the quantity of flow from MLS N1-B, cause odor or other nuisances, cause upstream impacts, or local sewage overflows at MLS N1-B. In performing the Work shown and specified, Contractor shall plan and schedule the Work to meet both the constraints outlined in this Section and all other sequencing and work requirements specified in these Contract Documents.

C. Contractor has the option of providing additional temporary bypass that can eliminate a constraint provided it is done without additional cost to the County, presents no safety hazards, and provided that all requirements of these Specifications are fulfilled. An alternate flow bypass plan can be submitted for review and approval by the Engineer and County. However, the alternate flow bypass plan may not be implemented prior to approval from the Engineer and County.

D. Contractor shall be responsible for coordinating all shutdowns with the Engineer and County. Contractor shall, whenever possible, combine discrete shutdown procedures into a single shutdown when the duration of the shutdowns or the Work requirements allow such combining to occur on a unit process or work area. The intent of combining procedures is to minimize the impacts upon MLS N1-B operations and processes by limiting the number of shutdowns required.

E. Contractor shall not shut-off or disconnect any operating system of the MLS N1-B unless approved by the Engineer, in writing. All MLS N1-B equipment operations and shutdowns shall be executed by the County, unless otherwise noted.

F. Contractor shall refer to the Drawings and other Sections, for definition of the equipment, piping, material and appurtenances to be removed, turned over to the County and stored on site, or to become the property of Contractor and removed from the site.

G. Contractor shall be responsible for design and supply of all temporary pipelines, valves, pumps, meters, spare parts, electrical, controls, and any other appurtenances required for the installation and operation of temporary bypass lines, pumping systems, or conveyance systems required to maintain operations of the MLS N1-B during construction activities. Contractor shall submit to the Engineer, for review and approval, the design for all temporary lines, pumping, or conveyance systems at least thirty days prior to the commencement of the construction of the Work associated with the temporary facilities.

H. Contractor shall stage the work to maintain unobstructed access for emergency vehicles to all buildings, building Siamese connections, and fire hydrants.

1.02 GENERAL CONSTRAINTS

A. New units provided under this contract may only be used (e.g., permanent pumps used in place of temporary bypass pumps) after the specified testing is completed and the units are accepted for use by the Engineer, in writing.

B. The following constraints shall be applied to all equipment appurtenant utility systems on the MLS N1-B site.

1. Load limits on Access Roads: Contractor shall not exceed this weight limit of local roads and shall provide means of protecting the underground facilities onsite.

2. Safety Barriers: Contractors shall place safety barriers around unsafe areas located around operational areas accessible to County personnel.

3. Personnel Access: personnel shall have access to all areas which remain in operation throughout the construction period.

4. Potable Water System: The existing potable water system shall be kept in operation at all times.

5. Storm drainage: Storm drainage on the site shall be operational at all times, unless otherwise specified.

6. Building Heating and Ventilating: In Contractor's Work areas and areas affected by Contractor's operations, building heating and ventilating shall be both provided and maintained in structures. The temperatures to be maintained in any area occupied by County personnel shall be maintained at a minimum of 55°F and not greater than 90°F.

7. Power, Light and Communication Systems: Electric power, lighting service and communication systems shall be maintained in uninterrupted operation in all areas.

8. Sump Pumps and Sumps: All existing sumps shall be maintained in an operable condition with either existing pumps or temporary pumps provided by Contractor. Interim piping, power and controls shall be provided by Contractor, as required by the construction sequence and as directed by the Engineer.

9. Seal and Service Water Piping: A supply of service and seal water and the necessary connections to existing equipment shall be maintained during construction, unless otherwise specified. Interim piping shall be provided by Contractor, as required.

10. The County will assist Contractor in dewatering process the wet wells. It is Contractor's responsibility to clean the wet wells and dispose contents off-site and at their expense any residuals, and in accordance with Federal, State, and Local regulations having jurisdiction. The Contractor shall maintain a clean and dry work area by pumping and disposing of all washdown and cleaning water, stormwater, and other liquids that accumulate in the work areas.

11. All shutdowns of existing systems or piping shall be performed by County personnel. All existing valves and gates shall be operated by County personnel unless the Contractor has been provided written authorization by the Engineer to perform such activities.

12. Temporary Partitions and Enclosures: Contractor shall provide temporary partitions and enclosures as necessary to maintain dust-free, heated and ventilated spaces in all areas which are adjacent to the Work and which must be kept operational by the COUNTYF.

13. Dead End Valves of Pipe: Contractor shall provide blind flanges on all valves or pipes which dead-end a line on a temporary or permanent basis. Blind flanges shall be braced and blocked, as required or as directed by the Engineer in the field.

1.03 SHUTDOWNS

A. GENERAL

1. A shutdown shall be defined as a portion of the normal operation of a plant unit that has to be suspended or taken out of service in order to perform the specified Work.

2. For each shutdown, Contractor shall conduct a hazard safety assessment, compile an inventory of labor, tools, safety equipment and materials required to perform the tasks, develop an estimate of the time required to complete each task, and prepare a written description of steps required to complete all task of the shutdown. In addition, the MOPO form provided in Section 01999 shall be completed for each shutdown. Contractor shall also request in writing from the Engineer, approval for each shutdown a minimum of 3 calendar days prior to the proposed shutdown date. No shutdown shall be initiated until the inventory of materials and labor is verified by the Engineer on site at least one week prior to the proposed start date. All shutdowns of existing systems or piping shall be performed by County personnel and all existing valves and gates shall be operated by County personnel unless the Contractor has been specifically authorized in writing by the Engineer to perform such activities.

   Contractor shall arrange for a minimum of one meeting with the County and the Engineer for each shutdown. The meeting shall include a general planning strategy meeting for the shutdown, review the roles of the Contractor, Engineer and County in the shutdown and shall, in detail, review all aspects of the shutdown, and review of the the shutdown plan and MOPO shall be presented and be final for this meeting. The meeting shall be, at a minimum, 3 days before the desired shutdown.

3. The Work required herein, and any other Work required by the Engineer which may interrupt the normal operations shall be accomplished at such times that will be convenient to the County.

4. Contractor shall also have on hand and located in close proximity to the Work area, all tools, equipment, spare parts and materials, both temporary and permanent, necessary to complete each Work category without interruption. Adequate numbers of personnel shall be scheduled for each shutdown, so that the Work shall be accomplished within the specified time frame. Prefabrication of all piping and other assemblies shall be completed, to the greatest degree possible, prior to any shutdowns. The Engineer shall inspect the work area, tools, equipment, spare parts and materials prior to the shutdown and shall be satisfied that Contractor has

complied with these requirements, to the fullest extent possible, before shutdowns will be authorized. This review; however, does not relieve the Contractor from having full responsibility of the shutdown activity for having the appropriate tools, equipment, spare parts and materials, both temporary and permanent, necessary to complete each Work category without interruption.

5. If Contractor's procedures cause an unscheduled shutdown of the facilities, Contractor shall perform Work as necessary to immediately re-establish satisfactory operation. Contractor shall notify the Engineer, in writing, immediately of any unscheduled shutdown. Contractor shall permit County's personnel to work with Contractor's personnel, as required, to maintain the MLS N1-B flows in continuous satisfactory operation. Unscheduled shutdown and/or interruptions of continued safe and satisfactory operation of the facilities that result in any fines levied shall be the responsibility of Contractor if it is demonstrated that Contractor was negligent in his Work or did not exercise proper precautions in the conduct of his Work.

B. Shutdowns of Electrical Systems: Contractor in conjunction with the County and appropriate MLS N1-B personnel shall lock out and tag circuit breakers and switches operated by the County and shall check cables and wires to be sure that they are de-energized to ground potential before Work begins. Upon completion of the Work, Contractor shall remove the locks and tags and notify the Engineer that the facilities are available for use.

1.04 OVERTIME

A. All overtime Work by Contractor necessary to conform to the requirements of this Section and related Sections shall be performed by Contractor, at no cost to the County and shall be performed in accordance with the General Conditions. Contractor shall make no claims for extra compensation as a result thereof.

1.05 MAINTENANCE OF PLANT OPERATIONS SCHEDULE AND NARRATIVE DESCRIPTIONS

A. In order to maintain a continuous plant operation during construction, a blank and a completed sample Maintenance of Plant Operations (MOPOs) Schedule is included in Section 01999. Within each MOPO item's procedural steps, time and scheduling constraints and milestone dates shall be outlined.

B. Contractor shall develop a detailed narrative description, in addition to that provided in the MOPO, for all shutdowns. These narrative descriptions shall be catalogued and submitted to the Engineer for review and approval within ninety days following the Notice to Proceed. Contractor shall maintain these narratives in a binder which shall be reviewable at any time by the Engineer. These narratives shall be clearly identifiable on and be able to be cross-referenced with the project schedule maintained by the Contractor. As adjustments are made or made necessary by the progression of the Work, the Contractor shall modify and resubmit these narrative descriptions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01045 CUTTING AND PATCHING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.
2. Uncover portions of the work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Contract Documents.
5. Provide penetrations of non-structural surfaces for installation of piping and electrical conduit.

PART 2 PRODUCTS

2.01 MATERIALS

Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to County. Do not proceed with work until County has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value to integrity of affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work and maintain excavations free from water.

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

END OF SECTION

SECTION 01050 FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying service required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

1.02 QUALIFICATION OF SURVEYOR AND ENGINEER

All construction staking shall be conducted by or under the supervision of a Florida Registered Professional Surveyor and Mapper. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the County.

1.03 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are designated on the Contract Drawings.

B. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

Make no changes or relocations without prior written notice to County.

Report to County when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

Require surveyor to replace project control points which may be lost or destroyed.

Establish replacements based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

1.05 RECORDS

The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings per Section 01720.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01090 REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

Abbreviations and acronyms used in Contract Documents to identify reference standards.

A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

B. Publication Date: The most recent publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES AND ADDRESSES OR ORGANIZATIONS

Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capital Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
1221 Avenue of the Americas
New York, NY 10020

AISI American Iron and Steel Institute
1000 16th Street NW
Washington, DC 20036

ANSI American National Standards Institute
1430 Broadway
New York, NY 10018

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
179l Tullie Circle, N.E.
Atlanta, GA 30329

ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 2501 N.W. 7th Street Miami, FL 33125
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
FDEP	Florida Department of Environmental Protection 3900 Commonwealth Blvd. Tallahassee, Florida 32399
FDOT	Florida Department of Transportation Standards Specifications for Road and Bridge Construction Maps & Publication Sales - Mail Station 12 605 Suwannee St. Tallahassee, FL 32399-0450
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
MCPW UTIL STD	Manatee County Utility Engineering 1022 26th Ave E Bradenton, FL 34208
MLSFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
MMA	Monorail Manufacturer's Association 1326 Freeport Road Pittsburgh, PA 15238
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEMA	National Electrical Manufacturer's Assoc.

2101 L Street N.W.
Washington, DC 20037

OHSA Occupational Safety and Health Assoc.
5807 Breckenridge Pkwy., Suite A
Tampa, FL 33610-4249

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 20076

PCI Prestressed Concrete Institute
20 North Wacker Drive
Chicago, IL 60606

SDI Steel Door Institute
712 Lakewood Center North
Cleveland, OH 44107

SMACNA Sheet Metal and Air Conditioning Contractor's National Association
8224 Old Court House Road
Vienna, VA 22180

SSPC Steel Structures Painting Council
402 24th Street, Suite 600
Pittsburgh, PA 15213

SWFWMD Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604-6899

UL Underwriter's Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01150 MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Form section of the Contract Documents. Payment will be made based on the specified items included in the description in this section for each bid item.

B. All contract prices included in the Bid Form section will be full compensation for all shop drawings, working drawings, labor, materials, tools, equipment and incidentals necessary to complete the construction as shown on the Drawings and/or as specified in the Contract Documents to be performed under this Contract. Actual quantities of each item bid on a unit price basis will be determined upon completion of the construction in the manner set up for each item in this section of the Specifications. Payment for all items listed in the Bid Form will constitute full compensation for all work shown and/or specified to be performed under this Contract.

1.02 ESTIMATED QUANTITIES

The quantities shown are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The County does not assume any responsibility for the final quantities, nor shall the Contractor claim misunderstanding because of such estimate of quantities. Final payment will be made only for satisfactorily completed quantity of each item.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

No payment will be made for work constructed outside the authorized limits of work.

1.04 MEASUREMENT STANDARDS

Unless otherwise specified for the particular items involved, all measurements of distance shall be taken horizontally or vertically.

1.05 AREA MEASUREMENTS

In the measurement of items to be paid for on the basis of area of finished work, the lengths and/or widths to be used in the calculations shall be the final dimensions measured along the surface of the completed work within the neat lines shown or designated.

1.06 LUMP SUM ITEMS

Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum items. Lump sum contracts shall be complete, tested and fully operable prior to request for final payment. Contractor may be required to provide a break-down of the lump sum totals. All lump sum items shall be paid upon a percent complete basis.

Any related work not specifically listed, but required for satisfactory completion of the work shall be considered to be included in the scope of the appropriate listed work items.

No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work. Final payments shall not be requested by the Contractor or made by the County until as-built (record) drawings have been submitted and approved by the County.

1. Project signs and photographs.
2. Removal, repair, replacement or relocation of all signs, walls, private irrigation systems and related items.
3. Rubbish and spoil removal.
4. Shop Drawings, Working Drawings.
5. Clearing, grubbing and grading except as hereinafter specified.
6. Trench excavation, including necessary pavement removal and rock removal, except as otherwise specified.
7. Dewatering and disposal of surplus water.
8. Structural fill, backfill, and grading.
9. Replacement of unpaved roadways, and shrubbery plots.
10. Cleanup & miscellaneous work.
11. Foundation and borrow materials, except as hereinafter specified.
12. Testing and placing system in operation.
13. Any material and equipment required to be installed and utilized for the tests.
14. Pipe, structures, pavement replacement, asphalt and shell driveways and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
15. Maintaining the existing quality of service during construction.
16. Appurtenant work as required for a complete and operable system.
17. Seeding and hydromulching.

BID ITEM NO. 1: MOBILIZATION, DEMOBILIZATION, AND SITE WORK (LS).

Payment for MLS N1-B improvements will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Bid Item No. 1 includes but is not limited to mobilization, demobilization and all associated site work (including but not limited to erosion control and required dewatering for trenching or foundation) and incidentals that is not covered in Bid Items No. 2 thru 9 as shown in Construction Documents and as required for a complete system and project. This item includes survey and control, record drawings, and any admirative items associated with contract management, bonds, insurance, preparatory work and operations in mobilizing for beginning Work on the project, etc. Partial payments for MLS N1-B Mobilization, Demobilization and Site Work shall be made on a percent complete basis.

BID ITEM NO. 2: MLS N1-B DEMOLITION (LS).

Payment for MLS N1-B demolition item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. MLS N1-B demolition includes but is not limited to careful removal and disposal of existing pumps, pump pads, comminutor, piping, strap-on magnetic flow, meter, valves, appurtenances, and drives. Note that this item does not include electrical items such as conduit, conductors, or control panels, as those items are included in another bid item. Also included is the lump sum price includes all removal, demolition, hauling, shipping, disposal (in accordance Federal, State, and Local requirements having jurisdiction) and freight as well as incidentals and other demolition as shown/required to perform work as shown in Construction Documents. Partial payments for MLS N1-B Demolition shall be made on a percent complete basis.

BID ITEM NO. 3: FURNISH AND INSTALL PUMPS, VALVES, AND APPURTENANCES (LS).

Payment for MLS N1-B furnish and install pumps, valves, and appurtenances item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to furnishing and installing (building of) pump pads (including steel), pumps, suction and discharge piping shown on drawings, valves, fittings appurtenances, pump frame plate, equipment connection fitting, and drives. Note the lump sum price does not include electrical, instrumentation, or SCADA conduit, as that is provided in another bid item. Partial payments for MLS N1-B furnish and install pumps, valves, and appurtenances shall be made on a percent complete basis.

BID ITEM NO. 4: ABOVE GRADE MAGNETIC FLOW METER AND SITE PIPING (LS).

Payment for MLS N1-B above grade magnetic flow meter and site piping item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to furnishing and installing (building of) concrete magnetic flow meter pad (including steel), magnetic flow meter, valves, fittings, appurtenances, concrete pipe supports, pipe restraints, mechanical magnetic meter support, and below grade piping, fittings, wyes, valves, and valve boxes. The bid item does include connection to the existing force main discharge. Any removal of sewage, clearing of existing pipes of wastewater material, and of the below grade force main shall be included in Bid Item No. 2, demolition. Note the lump sum price does not include electrical, instrumentation, or SCADA conduit, as that is provided in another bid item. This bid item also does not include bypass pumping. Note that full payment on this item is contingent on passing any required testing and startup procedures. Partial payments for MLS N1-B above grade magnetic flow meter shall be made on a percent complete basis.

BID ITEM NO. 5: PRE-ENGINEERED CONCRETE BUILDING (LS).

Payment for MLS N1-B pre-engineered concrete building item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to striping and undercutting foundational area of the building location, foundation construction, all new sidewalk associated with the project, any required connections of the pre-engineered building to the foundation, HVAC, fire protection, doors, steps, and interior building pads. Note the lump sum price does not include electrical, instrumentation, or SCADA conduit, as that is provided in another bid item. Partial payments for MLS N1-B pre-engineered concrete building shall be made on a percent complete basis.

BID ITEM NO. 6: TEMPORARY BYPASS PUMPING (LS).

Payment for MLS N1-B temporary bypass pumping item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to providing a temporary bypass system, including bypass pumping skids, inflatable plugs, temporary suction and discharge piping, mechanical connections, and tapping sleeve and valve. This bid item includes all temporary electrical connections, fuel, SCADA, and controls required to run the temporary bypass system. All disposal, cleaning, and removal of the temporary bypass system after the equipment's intended use. The item also includes 24-hour live monitoring of the bypass system and associative alarms, barricades, fasteners, needed anchors or other methods or restraint needed to secure the equipment and pipping. Noise abatement procedures shall also be used and included in this bid item. Note this bid item includes all excavation and fill required for the tapping sleeve and valve and physical connection. Partial payments for MLS N1-B temporary bypass pumping shall be made on a percent complete basis.

BID ITEM NO. 7: FURNISH AND INSTALL COMMINUTOR (LS).

Payment for MLS N1-B furnish and install comminutor item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to providing installing guide channels to isolate the flow within the channel, pressure wash and clean the channel, and furnishing and installing the comminutor. This bid item includes any repairs to the channel required, equipment anchorage, and any disposal and permitting required. Partial payments for MLS N1-B furnish and install comminutor shall be made on a percent complete basis.

BID ITEM NO. 8: ELECTRICAL AND INSTRUMENTATION AND CONTROL IMPROVEMENTS.

Payment for MLS N1-B furnish and install electrical and instrumentation and control item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to conduit, conductor, electrical connections, control panels, automatic transfer switch, motor control center, wiring, cables, raceways, and field instrument and devices. . This bid item includes require labeling and testing as required for a complete and operational electrical and instrumentation control system. This bid item does not include installation of the magnetic flow meter, but does include conduit, wiring, and programing that is associated with the magnetic flow meter. The bid item includes the control system integration, programing of the existing system, and coordination with the power company. Partial payments for MLS N1-B electrical and instrumentation and control improvements shall be made on a percent complete basis.

BID ITEM NO. 9: CLEANING OF THE WET WELL (LS)

Payment for MLS N1-B cleaning of the wet well item will be made at the lump sum price named on the Bid Form and be on a percent complete basis. Improvements within this bid item includes but is not limited to pressure washing the stairs, platforms, grates, and channels (not associated with the comminutor channel) of the wet well, and disposal (including hauling) of trash, muck, biosolids, sewage, and debris as a result of draining and cleaning the wet well prior to coating repairs. Partial payments for MLS N1-B wet well cleaning shall be made on a percent complete basis.

BID ITEM NO. 10: WET WELL EXISTING COATING REMOVAL (SF)

Payment for MLS N1-B the wet well existing coating removal item will be made at the unit price named on the Bid Form and be on a square foot basis. Improvements within this bid item includes but is not limited removal of the existing coating system that is pulling away from the existing concrete of the wet well, and disposal of the removal of the existing coating system that requires removal. Preapproval for the coating to be removed shall be made prior to performing by the County and construction inspector. Partial payments for MLS N1-B wet well existing coating removal shall be made on a percent complete basis.

BID ITEM NO. 11: WET WELL COATING REPAIR (SF)

Payment for MLS N1-B wet well coating repair item will be made at the unit price named on the Bid Form and be on a square foot basis. The coating repair will include cleaning, all the necessary surface preparation of the surface per manufacturer's recommendations to apply the primer and/or coating system to an even surface and application of the coating system. Improvements within this bid item includes but is not limited to surface preparation, filler

application, and application of the coating system. The bid item includes storing of the coating system, preparation of coating (mixing), and removal of existing coating/material.

This bid item shall also include surface preparation items according to guidelines within the drawings, specifications, and manufacturer recommendations, and incidentals necessary to complete the bid item, ready for approval and acceptance by the County. Since it is impossible to determine the square footage required to be repaired prior to dewatering and cleaning the wet well, the actual number of square feet of the area to be coated shall be agreed upon with the County Inspector prior to commencement of any work. The partial payments for MLS N1-B wet well coating repair shall be made on a square foot basis and be contingent to successful acceptance following specified testing.

BID ITEM NO. 12: WET WELL REHAB (SF)

Payment for MLS N1-B wet well rehab item will be made at the unit price named on the Bid Form and be on a square foot basis. Any wet well cleaning, coating removal, surface cleaning, preparation and application of the coating system shall be included in Bid Items 9, 10 and 11. This wet well rehab item is for cleaning, all necessary surface preparation of the surface per manufacturer's recommendations to repair concrete including rebar repair. Improvements within this bid item includes but is not limited to cleaning, surface preparation, and application of the concrete repair. The bid item includes storing of the concrete repair system and installation of the concrete repair system. Since it is impossible to determine the square footage required to be rehabbed prior to dewatering and cleaning the wet well, the actual number of square feet of the area to be coated shall be agreed upon with the County Inspector prior to commencement of any work. The partial payments for MLS N1-B wet well rehab shall be made on a square foot basis and be contingent to successful acceptance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01152 REQUESTS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Submit Applications for Payment to the Project Manager or as directed at the preconstruction meeting, in accordance with the schedule established by Conditions of the Contract and Agreement between County and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the County with itemized data typed in accordance with the Bid Form.

B. Provide construction photographs in accordance with Contract Documents.

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the County requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.04 PREPARATION OF APPLICATION FOR FINAL PAYMENT

Fill in application form as specified for progress payments.

1.05 SUBMITTAL PROCEDURE

A. Submit applications for payment at the times stipulated in the Agreement.

B. Number: Three (3) copies of each application; all signed and certified by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01153 CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

A. Change Order: A written order signed by the Owner, the Architect/Engineer and the Contractor authorizing a change in the Project Plans and/or Specifications and, if necessary, a corresponding adjustment in the Contract Sum and/or Contract Time, pursuant to Article V of the General Conditions of the Construction Agreement.

B. Administrative Change Adjustment: Minor change order under 10% of project cost or 20% time, does not have to be Board approved.

C. Field Directive: A written order issued by Owner which orders minor changes in the Work not involving a change in Contract Time, to be paid from the Owner's contingency funds.

D. Field Order: Minor change to contract work that does not require adjustment of contract sum or expected date of completion.

1.02 REQUIREMENTS INCLUDED

A. The Contractor shall promptly implement change order procedures:

1. Provide full written data required to evaluate changes.
2. Maintain detailed records of work done on a time-and-material/force account basis.
3. Provide full documentation to County on request.

B. The Contractor shall designate a member of the Contractor's organization who:

1. Is authorized to accept changes to the Work.
2. Is responsible for informing others in the Contractor's employ of the authorized changes into the Work.

1.03 PRELIMINARY PROCEDURES

A. Project Manager may initiate changes by submitting a Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.
3. The projected time extension for making the change.
4. A specified period of time during which the requested price will be considered valid.
5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to the Project Manager, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.

4. Statement of the effect on the work of separate contractors.
5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.04 FIELD ORDER CHANGE

A. In lieu of a Change Order, the Project Manager may issue a Field Order for the Contractor to proceed with additional work within the original intent of the Project.

B. Field Order will describe changes in the work, with attachments of backup information to define details of the change.

C. Contractor must sign and date the Field Order to indicate agreement with the terms therein.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow the County to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.
2. Equipment required.
3. Products required.
   a. Recommended source of purchase and unit cost.
   b. Quantities required.
4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal.

1. Name of the County's authorized agent who ordered the work and date of the order.
2. Date and time work was performed and by whom.
3. Time record, summary of hours work and hourly rates paid.
4. Receipts and invoices for:
   a. Equipment used, listing dates and time of use.
   b. Products used, listing of quantities.
   c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

A. Project Manager will prepare each Change Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.07 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Project Manager initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by the Contractor, or requests from the County, or both.

B. Once the form has been completed, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to County for approval. The County will distribute executed copies after approval by the Board of County Commissioners.

1.08 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. County's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as approved by the County.
3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.
2. Those mutually agreed upon between County and Contractor.

1.09 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION

A. Refer to Article V.5.6 of the General Conditions of the Construction Agreement.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time. Revise sub schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01200 PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The County shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. County's Engineer.
2. County's Project Manager
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:
   a. List of major subcontractors.
   b. Projected Construction Schedules.
   c. Coordination of Utilities
2. Critical work sequencing.
3. Project Coordination.
   a. Designation of responsible personnel.
   b. Emergency contact persons with phone numbers.
4. Procedures and processing of:
   a. Field decisions.
   b. Submittals.
   c. Change Orders.
   d. Applications for Payment.
5. Procedures for maintaining Record Documents.
6. Use of premises:
   a. Office, work and storage areas.
   b. County's REQUIREMENTS.
7. Temporary utilities.
8. Housekeeping procedures.
9. Liquidated damages.
10. Equal Opportunity Requirements.
11. Laboratory testing.
12. Project / Job meetings: Progress meeting, other special topics as needed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 GENERAL

1.01 GENERAL

A. The Contractor shall submit to the County for review and approval: working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this section called data), and material samples (hereinafter in this section called samples) as are required for the proper control of work, including, but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the County. This log should include the following items:

1. Submittal description and number assigned.
2. Date to County.
3. Date returned to Contractor (from County).
4. Status of Submittal (No exceptions taken, returned for confirmation or resubmittal, rejected).
5. Date of Resubmittal and Return (as applicable).
6. Date material released (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Projected date and required lead time so that product installation does not delay contact.
10. Status of O&M manuals submitted.

C. Submittals covered by these requirements include manufacturers' information, shop drawings, test procedures, test results, samples, requests for substitutions, and miscellaneous work-related submittals. Submittals shall also include, but not be limited to, all mechanical, electrical and electronic equipment and systems, materials, reinforcing steel, fabricated items, and piping and conduit details. The Contractor shall furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules, and manufacturer's installation and other instructions as specifically required in the contract documents to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the contract documents.

D. The contractor shall submit copies of all permit applications, permit submittals, permit comments and permit approvals.

E. Within 10 calendar days after Notice to Proceed, Contractor shall submit a complete list of all anticipated submittals including shop drawings, submittals, and product data with an anticipated delivery date to the Engineer and review and approval times. This shall be reviewed during the Project Kickoff Meeting and shall be continuously updated and reviewed during Project Progress Meetings.

1.02 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where his submittal may affect the work of another Contractor or the County. The Contractor shall coordinate submittals among his subcontractors and suppliers including those submittals complying with unit responsibility requirements specified in paragraph 11000-1.02 C and applicable technical sections.

The Contractor shall coordinate submittals with the work so that work will not be delayed. Contractor shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals. The Contractor shall not proceed with work related to a submittal until the submittal process is complete. For the Contractor to proceed a submittal shall be reviewed, commented and shall be returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted."

The Contractor shall certify on each submittal document that the Contractor has reviewed the submittal, verified field conditions, and complied with the contract documents.

The Contractor may authorize in writing a material or equipment supplier to deal directly with the Engineer regarding a submittal. These dealings shall be limited to contract interpretations to clarify and expedite the work.

The Engineer will review each submittal up to two times. The Contractor shall pay directly to the Engineer for all additional reviews on a time and materials basis but not to exceed 24 hours per submittal review.

It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the County 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 County without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the contract Documents.

Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

The Contractor shall furnish the County a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the County, with No Exceptions Taken or Approved As Noted.

The Contractor shall submit to the County all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and appropriate action from the time the County receives them.

All material & product submittals, other than samples, may be transmitted electronically as a pdf file. All returns to the contractor will be as a pdf file only unless specifically requested otherwise.

The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by County of the necessary Shop Drawings.

1.03 CATEGORIES OF SUBMITTALS

A. GENERAL

Submittals fall into two general categories; submittals for review and comment, and submittals which are primarily for information only. Submittals which are for information only are generally specified as PRODUCT DATA in Part 2 of applicable specification sections.

B. SUBMITTALS FOR REVIEW AND COMMENT

All submittals except where specified to be submitted as product data for information only shall be submitted by the Contractor to the Engineer for review and comment.

C. SUBMITTALS (PRODUCT DATA) FOR INFORMATION ONLY

Where specified, the Contractor shall furnish submittals (product data) to the Engineer for Information only. Submittal requirements for operation and maintenance manuals, which are included in this category, are specified in Section 01730.

1.04 TRANSMITTAL PROCEDURE

A. GENERAL

Unless otherwise specified, submittals regarding material and equipment shall be accompanied by Transmittal Form 01300-A specified in Section 01999. Submittals for operation and maintenance manuals, information and data shall be accompanied by Transmittal Form 01730-A specified in Section 01999. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.

A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor.

Resubmittals shall have the following format: "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.

B. DEVIATIONS FROM SPECIFICATION AND DRAWING REQUIREMENTS

Each submittal shall be accompanied with a copy of the related specification section, with addendum updates included, and all applicable and referenced paragraphs of other 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 Vendor, 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 will signify compliance on the part of the Vendor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

If the Contractor proposes to provide material, equipment, or method of work which deviates from the project manual, he shall indicate so under "deviations" on the transmittal form accompanying the submittal copies. The deviations noted on the form shall summarize major deviations or groups of deviations. Each submittal shall be accompanied with a detailed list of all deviations with an explanation describing the justification for the deviation.

C. SUBMITTAL COMPLETENESS

Submittals which do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

1.05 REVIEW PROCEDURE

A. GENERAL

Submittals are specified for those features and characteristics of materials, equipment, and methods of operation which can be selected based on the Contractor's judgment of their conformance to the specified requirements. Other features and characteristics are specified in a manner which enables the Contractor to determine acceptable options without submittals. The review procedure is based on the Contractor's guarantee that all features and characteristics not requiring submittals conform as specified. Review shall not extend to means, methods, techniques, sequences or procedures of construction, or to verifying quantities, dimensions, weights or gages, or fabrication processes (except where specifically indicated or required by the project manual) or to safety precautions or programs incident thereto. Review of a separate item, as such, will not indicate approval of the assembly in which the item functions.

When the contract documents require a submittal, the Contractor shall submit the specified information as follows:

1. Submittals and Product Data shall be submitted electronically as a single PDF document.

The following submittals are excluded and require hard copies. A summary of the types of submittals and the number of copies required for review by the Engineer is as follows:

Copies	Type of Submittal
2	Permit Applications, Permits & Permit Submittals
5	General Submittals & Plans of Operation
5	Construction Schedule
5	Schedule of Payment Items/ Values
5	Progress Estimates & Construction Photographs
8	Equipment Submittals and Shop Drawings
2	Certificates of Compliance
2	Product Samples
2	Project Record Documents
5	Technical Manuals, O&M Manuals & Spare Parts List
6	Application for Payment
3	Consent of Sureties, Partial/Final releases of Liens
2	Elevation Certificates

B. SUBMITTALS FOR REVIEW AND COMMENT

Unless otherwise specified, within 14 calendar days after receipt of a submittal for review and comment, the Engineer shall review and return three marked-up three copies of the submittal. The reproducible original will be retained by the Engineer. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment or work method complies with the project manual, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.

2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a corrected copy shall be provided.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT." Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

4. If the review indicates that the material, equipment, or work method does not comply with the project manual, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations which have not been identified clearly may be rejected. Except at his own risk, the Contractor shall not undertake the work

covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

C. SUBMITTALS (PRODUCT DATA) FOR INFORMATION ONLY

Such information is not subject to submittal review procedures and shall be provided as part of the work under this contract and its acceptability determined under normal inspection procedures.

1.06 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the County's Representative or the County, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the County has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

1.07 LIST OF SECTIONS REQUIRING SUBMITTALS

The following submittal list is provided as a courtesy to the Contractor and does not relieve the Contractor of analyzing in its entirety the Contract Documents and providing all submittals, shop drawings, product data and all other information specified, inferred or required to meet the intent of the Contract Documents.

1. Section 01310 Construction Schedule & Project Restraints
2. Section 01380 Construction Photographs and Videos
   a. Preconstruction Photographs and Video
3. Section 01560 Environmental Controls
4. Section 01664 Training
5. Section 01730 Operation and Maintenance Data
6. Section 01900 Structural Design and Anchorage Requirements for Nonstructural Components and Nonbuilding Structures
7. Section 02100 Site Preparation
8. Section 02615 Ductile Iron Pipe and Fittings
9. Section 02640 Valves and Appurtenances
10. Section 03300 Cast-in-Place Concrete
11. Section 05501 Anchor Bolts
12. Section 07100 Waterproofing, Dampproofing and Caulking

13. Section 11000 General Requirements for Equipment

14. Section 11002 Rigid Equipment Mounts

15. Section 11050 General Requirements for Pumping Equipment

16. Section 11060 Electric Motors

17. Section 11069 Adjustable Frequency Drives

18. Section 11305 Submersible Wastewater Pumps – Variable Speed

19. Section 16000 General Requirements for Electrical Work

20. Section 16260 Automatic Transfer Switches

21. Section 16431 Arc Flash Analysis, Short Circuit Study, and Protective Device Coordination Report

22. Section 17000 General Requirements for Instrumentation and Control

1.08 LIST OF SECTIONS REQUIRING PRODUCT DATA

Reference the individual specification sections.

1.09 COUNTY'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

A. The County's review of drawings, data and samples submitted by the Contractor shall cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules shall be general and shall not be construed:

1. As permitting any departure from the Contract requirements.
2. As relieving the Contractor of responsibility for any errors, including details, dimensions and materials.
3. As approving departures from details furnished by the County, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the County finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or time for performance, the County may return the reviewed drawings without noting any exception.

D. When reviewed by the County, each of the Shop and Working Drawings shall be identified as having received such review being so stamped and dated. Shop Drawings stamped "REJECTED" and with required corrections shown shall be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the County on previous submissions. The Contractor shall make any corrections required by the County.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the County.

G. The County shall review a submittal/resubmittal a maximum of three (3) times after which cost of review shall be borne by the Contractor. The cost of engineering shall be equal to the County's actual payroll cost.

H. When the Shop and Working Drawings have been completed to the satisfaction of the County, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the County.

I. No partial submittals shall be reviewed. Incomplete submittals shall be returned to the Contractor and shall be considered not approved until resubmitted.

1.10 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, drawings, setting drawings, schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the County and shall bear the Contractor's stamp of approval and original signature as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval and original signature shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the drawing.
2. Date of Drawing or revision.
3. Name of project building or facility.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the work.
6. Specification title and number.

D. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility of executing the work in accordance with the Contract, even though such drawings have been reviewed.

E. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item

thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the County along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least one (1) year.

H. Only the County will utilize the color "red" in marking shop drawing submittals.

1.11 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's fabrication and erection drawings for structures such as roof trusses, steelwork, precast concrete elements, bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work; underpinning; and for such other work as may be required for construction of the project.

B. Copies of working drawings as noted above, shall be submitted to the County where required by the Contract Documents or requested by the County and shall be submitted at least thirty (30) days (unless otherwise specified by the County) in advance of their being required for 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. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the County, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the County and Engineer shall not have responsibility therefor.

1.12 SAMPLES

A. The Contractor shall furnish, for the review of the County, samples required by the Contract Documents or requested by the County. Samples shall be delivered to the County as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the County.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.
3. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of product.
2. Name of Contractor and Subcontractor.
3. Material or equipment represented.
4. Place of origin.
5. Name of Producer and Brand (if any).
6. Location in project.
   (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
7. Reference specification paragraph.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the County. Review of a sample shall be only for the characteristics or use named in such and shall not be construed to change or modify any Contract requirements.

E. Reviewed samples not destroyed in testing shall be sent to the County or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the reviewed samples. If requested at the time of submission, samples which failed testing or were rejected shall be returned to the Contractor at his expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310 CONSTRUCTION SCHEDULE & PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the County and accomplished in a logical order to maintain utilization and flow through existing facilities and public properties and rights-of-way and to allow construction to be completed within the time allowed by Contract Documents and in the manner set forth in the Contract.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 p.m. and 7:00 a.m. nor on weekends or legal holidays without written permission of the County. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the County. Such permission, however, may be revoked at any time by the County if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper facility operations.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow County to review Contractor's planning, scheduling, management and execution of the work; to assist County in evaluating work progress and make progress payments and to allow other contractors to cooperate and coordinate their activities with those of the Contractor.

2.02 FORM OF SCHEDULES

A. Prepare schedules using the latest version of Microsoft Project, or other County approved

software, in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Values. Activity durations shall be in whole working days. In addition, man-days shall be shown for each activity or tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 8-1/2 inches by 11 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief, but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by County to review all submittals as set forth in the Contract Documents; items of work required of County to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with County.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittal schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the County, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and activity duration equal to zero work days.

2.04 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the monthly report period and actual start
   dates for activities commenced during the monthly report period.
2. Anticipated start dates for activities scheduled to commence during the following monthly report period.
3. Changes in the duration of any activity and minor logic changes.
4. The progress along the critical path in terms of days ahead or behind the Contract date.
5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.
6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and restraints of each activity.
7. The narrative shall also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.
8. Original Contract date(s) shall not be changed except by Contract change order. A revision need not be submitted when the foregoing situations arise unless required by County. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.
9. Should County require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.05 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Terms and Conditions of the Contract and the General Conditions), monthly status reports, a start-up schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with the Contract Documents.

C. The finalized progress schedule discussed in the Contract Documents shall be the first monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the start date. The finalized schedule, if

concurred with by County, shall be the work plan to be used by the contractor for planning, scheduling, managing and executing the work.

E. The schedule diagram shall be formatted as above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. The Contractor shall submit progress schedules with each application for payment.

2.06 MONTHLY STATUS REPORTS

A. Contractor shall submit detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described above. The Monthly Report will be reviewed by County and Contractor at a monthly schedule meeting and Contractor will address County's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by County will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.07 STARTUP SCHEDULE

A. At least 60 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion, together with a supporting narrative. County shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of County's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by County, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest schedule of legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

2.08 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review and concurrence by County. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review when required by County.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01380 CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs or perform video, recording including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all construction areas.

B. Preconstruction record information shall consist of video recordings on digital video disks (DVD).

C. Construction progress information shall consist of photographs and digital photographs on a recordable compact disc (CD-R).

1.02 QUALIFICATIONS

A. All photography shall be done by a competent camera operator who is fully experienced and qualified with the specified equipment.

B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.03 PROJECT PHOTOGRAPHS

A. Provide one print of each photograph with each pay application.

B. Provide one recordable compact disc with digital photographs with each pay application.

C. Negatives:

1. All negatives shall remain the property of photographer.
2. The Contractor shall require that photographer maintain negatives or protected digital files for a period of two years from date of substantial completion of the project.
3. Photographer shall agree to furnish additional prints to County at commercial rates applicable at time of purchase. Photographer shall also agree to participate as required in any litigation requiring the photographer as an expert witness.

D. The Contractor shall pay all costs associated with the required photography and prints. Any parties requiring additional photography or prints shall pay the photographer directly.

E. All project photographs shall be a single weight, color image. All finishes shall be smooth surface and glossy and all prints shall be 8 inches x 10 inches.

F. Each print shall have clearly marked on the back, the name of the project, the orientation of view, the date and time of exposure, name and address of the photographer and the photographers numbered identification of exposure.

G. All project photographs shall be taken from locations to adequately illustrate conditions prior

to construction, or conditions of construction and state of progress. The Contractor shall consult with the County at each period of photography for instructions concerning views required.

1.04 VIDEO RECORDINGS

A. Video, recording shall be done along all routes that are scheduled for construction. Video, recording shall include full, recording of both sides of all streets and the entire width of easements plus 10 feet on each side on which construction is to be performed. All video recording shall be in full color.

B. A complete view, in sufficient detail with audio description of the exact location shall be provided.

C. The engineering plans shall be used as a reference for stationing in the audio portion of the recordings for easy location identification.

D. Two complete sets of video recordings shall be delivered to the County on digital video disks (DVD) for the permanent and exclusive use of the County prior to the start of any construction on the project.

E. All video recordings shall contain the name of the project, the date and time of the video, recording, the name and address of the photographer and any other identifying information required.

F. Construction shall not start until preconstruction video recordings are completed, submitted and accepted by the County. In addition, no progress payments shall be made until the preconstruction video recordings are accepted by the County.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01410 TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. County shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. County may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.
2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the Contract.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The County may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the County shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse County for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the County.

H. If the test results indicate the material or equipment complies with the Contract Documents, the County shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01510 TEMPORARY AND PERMANENT UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

The Contractor shall be responsible for furnishing all requisite temporary utilities, i.e., power, water, sanitation, etc. The Contractor shall obtain and pay for all permits required as well as pay for all temporary usages. The Contractor shall remove all temporary facilities upon completion of work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and Local codes and regulations and with utility company requirements.

C. Comply with County Health Department regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

Materials for temporary utilities may be "used". Materials for electrical utilities shall be adequate in capacity for the required usage, shall not create unsafe conditions and shall not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

Arrange with the applicable utility company for temporary power supply. Provide service required for temporary power and lighting and pay all costs for permits, service and for power used.

2.03 TEMPORARY WATER

A. The Contractor shall arrange with Manatee County Utilities Customer Service office to provide water for construction purposes, i.e., meter, pay all costs for installation, maintenance and removal, and service charges for water used.

B. The Contractor shall protect piping and fitting against freezing.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide sanitary facilities in compliance with all laws and regulations.

B. The Contractor shall service, clean and maintain facilities and enclosures.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall maintain and operate systems to assure continuous service.

B. The Contractor shall modify and extend systems as work progress requires.

3.02 REMOVAL

A. The Contractor shall completely remove temporary materials and equipment when their use is no longer required.

B. The Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities.

END OF SECTION

SECTION 01560 ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SITE MAINTENANCE

The Contractor shall keep the work site clean and free from rubbish and debris. Materials and equipment shall be removed from the site when they are no longer necessary. Upon completion of the work and before final acceptance, the work site shall be cleared of equipment, unused materials, and rubbish to present a clean and neat appearance.

1.02 TEMPORARY DAMS

Except in time of emergency, earth dams are not acceptable at catch basin openings, local depressions, or elsewhere. Temporary dams of sandbags, asphaltic concrete, or other acceptable material will be permitted to protect the work, provided their use does not create a hazard or nuisance to the public. Such dams shall be removed from the site as soon as they are no longer necessary.

Temporary waterlight leak containment filters shall be provided by the contractor for chemical, fuel, manual storage, etc. Temporary facilities shall be removed and properly disposed of after construction is completed.

1.03 TEMPORARY DRAINAGE

The Contractor shall control and eliminate the sources of pollutants in stormwater through the development and implementation of a Stormwater Management Plan (SWMP) as required and in accordance with local regulations. The Contractor shall provide the SWMP to the Engineer at least three weeks prior to ground disturbance. The SWMP must detail Best Management Practices (BMPs) that will be implemented during construction, which may include enlarging or supplementing existing stormwater facilities and temporary controls that will protect receiving waters and adjacent properties. BMPs should focus on reducing the source of sediment but may also include sediment removal controls. Existing stormwater facilities shall be protected during construction and all temporary BMPs shall be removed once the site is stabilized. Contractor shall perform inspections as required by the local regulations. Contractor shall keep the SWMP and inspection records on site (in the construction office trailer) at all times.

1.04 AIR POLLUTION CONTROL

The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of any legally constituted authority. He shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water, or other means as necessary. The use of water, in amounts which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.

1.05 NOISE CONTROL

Between 8:00 p.m. and 7:00 a.m., noise from Contractor's operations shall not exceed limits established by applicable laws unless a variance is accepted.

1.06 GROUND AND GROUNDWATER CONTAMINATION

The Contractor shall comply with all federal, state and local laws and regulations which apply to water pollution and soil contamination.

In order to minimize the possibility of water or soil contamination due to spills of crankcase oil, gasoline and other fuels, the Contractor shall designate an area for the storage and handling of lubricants, fuels and other supplies which is acceptable to the Engineer. The Contractor shall comply with all applicable federal, state and local rules and regulations related to the storage of fuels and chemicals and the reporting and cleanup of spills.

1.07 FLUORESCENT LIGHT BULBS, HIGH INTENSITY DISCHARGE BULBS AND BALLASTS

Disturbing, removing, replacing, and disposal of fluorescent or High Intensity discharge (HID) lamps or ballasts is authorized under the scope of this project provided the Contractor complies with requirements outlined within this paragraph.

A. FLUORESCENT LIGHT BALLASTS

Fluorescent light ballasts manufactured after 1979 that do not contain PCBs are marked by the manufacturer with the words “No PCBs”. If a fluorescent light ballast is not marked with the words “No PCBs” it shall be considered to contain PCBs.

Non-PCB ballasts shall be recycled by the contractor. The Contractor shall provide containers for the collection of these ballasts, and the Contractor shall carefully place all ballasts in these containers and close the lid securely. The labels on the containers shall be left intact, unmarked, uncovered, and otherwise completely legible. The labels shall state “Universal Waste Ballasts.”

PCB-containing fluorescent light ballasts that are intact and non-leaking shall be recycled by the Contractor. The Contractor shall provide containers for the collection of these recyclable materials. The Contractor shall carefully place these ballasts into the containers provided and shall tightly close the container when it is full. The labels on the containers shall be left intact, unmarked, uncovered, and otherwise completely legible. The labels shall state “Universal Waste Ballasts-PCBs.” The Contractor shall manage these materials as if these materials were hazardous waste.

PCB-containing light ballasts that were not previously identified as leaking but are discovered by the Contractor to be leaking prior to removal from fixtures shall cause the Contractor to stop work on the site and immediately notify the Engineer or the County.

PCB-containing fluorescent light ballasts that have been damaged by the Contractor (made to leak) shall cause the Contractor to stop work on the site immediately and notify the Engineer. The Contractor shall carefully place the damaged ballasts into steel UN stamped drums approved by DOT for shipping Hazardous Waste and shall securely close the lids. The ballasts shall then be transported off site by the Contractor and incinerated at an offsite facility by the Contractor in accordance with 40 CFR 761.75.

B. FLUORESCENT LIGHT TUBES AND HIGH INTENSITY DISCHARGE (HID) LAMPS

All fluorescent tubes and HID lamps that are removed as part of this work shall be removed intact and recycled by the Contractor to be handled as “universal waste lamps.”

The Contractor shall provide containers for the collection of these recyclable materials. The Contractor will carefully place all light tubes and/or lamps in these containers, keep the lid securely closed at all times, and protect the containers from precipitation. Containers shall be labeled in accordance with State Universal Waste requirements for storage and shipping. The labels shall state “Universal Waste Fluorescent Lamps” or “Universal Waste HID Lamps.” These two materials must be collected separately.

It is imperative that the Contractor does not discard fluorescent light tubes or HID lamps on site in dumpsters or other debris collection containers and shall take appropriate actions to manage them properly.

C. POLYCHLORINATED BIPHENYLS (PCBs)

If the Contractor believes they have discovered a PCB containing item not specified in the contract or Phase II ESA during the execution of work, the Contractor shall stop work on the site immediately and notify the Engineer. The Contractor shall not use or install any equipment containing PCBs at the MLS.

1.08 ILLEGAL DISCHARGE

At no time shall the Contractor release or dump solvents, paints, gasoline or other fuels or oils into any portion of the plant’s sewers or process facilities.

1.09 HAZARDOUS WASTES

The Contractor shall comply with all federal, state, and local laws and regulations which apply to the removal and disposal of any and all hazardous wastes encountered during demo of old structures, utilities, and materials required by this project.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01580 PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish, install and maintain County project identification signs.

B. Remove signs on completion of construction.

C. Allow no other signs to be displayed except for traffic control and safety.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

A. Two painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of County.
3. Names and titles of authorities as directed by County.
4. Prime Contractor.

B. Graphic design, style of lettering and colors: As approved by the County.

C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 PUBLIC NOTIFICATION

A. Door Hangers: The Contractor shall generate and distribute door hangers to all residents who will be impacted by project construction.

1. Residents impacted include anyone who resides inside, or within 500 feet of project limits of construction.

B. Door Hangers shall be distributed prior to start of construction of the project. Hangers shall be affixed to doors of residents via elastic bands or tape.

EXAMPLE:

PLEASE PARDON THE INCONVENIENCE WHILE THE ROADWAY IS BEING RECONSTRUCTED IN YOUR NEIGHBORHOOD

This project consists of utility improvements and the reconstruction of ??? Boulevard from U.S. ??? to ??? Street West. The project is expected to begin in August, 200X and be completed in July 200X.

Location Map

WE HOPE TO KEEP ANY INCONVENIENCE TO A MINIMUM. HOWEVER, IF YOU HAVE ANY PROBLEMS, PLEASE CONTACT THE FOLLOWING:

A. Contractor
Contractor Address
Contractor Phone (Site Phone)

Project Manager
PM Address
PM Phone No. & Ext.

B. Project Inspector
Inspector Phone Number

AFTER HOURS EMERGENCY NUMBER – (941) 747-HELP
THANK YOU FOR YOUR UNDERSTANDING AND PATIENCE
MANATEE COUNTY GOVERNMENT – PROJECT MANAGEMENT DEPT.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in the Contract Documents.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, size and colors selected.

3.02 MAINTENANCE

The Contractor shall maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.03 REMOVAL

The Contractor shall remove signs, framing, supports and foundations at completion of project.

END OF SECTION

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SECTION 01600 MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by the County.
3. Manufactured and Fabricated Products:
   a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
   b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
   c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.
   d. Products shall be suitable for service conditions.
   e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is specified.
5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to County. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with County prior to proceeding. Do not proceed with work without clear instructions.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions of any product or manufacturer not specifically named in a timely manner so as not to adversely affect the construction schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01620 STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Provide secure storage and protection for products to be incorporated into the work and maintenance and protection for products after installation and until completion of Work.

1.02 STORAGE

A. Store products immediately on delivery and protect until installed in the Work, in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Exterior Storage

1. Provide substantial platform, blocking or skids to support fabricated products above ground to prevent soiling or staining.
   a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
   b. Prevent mixing of refuse or chemically injurious materials or liquids.

A. Arrange storage in manner to provide easy access for inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.
2. Required environmental conditions are maintained on continuing basis.
3. Surfaces of products exposed to elements are not adversely affected. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the County. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the County.
2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the County until such time as the equipment is to be installed.
3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
4. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
5. Lubricants shall be changed upon completion of installation and as frequently as

required, thereafter during the period between installation and acceptance.

6. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 SUBSTANTIAL COMPLETION

A. The Contractor shall submit the following items when the Contractor considers the work to be substantially complete:

1. A written notice that the work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the County shall make an inspection to determine the status of completion.

C. Project record documents and operations and maintenance manuals must be submitted before the project shall be considered substantially complete.

D. If the County determines that the work is not substantially complete:

1. The County shall notify the Contractor in writing, stating the reasons.
2. The Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the County.
3. The County shall reinspect the work.

E. When the County finds that the work is substantially complete:

1. The Engineer shall prepare and deliver to the County a tentative Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a tentative list of the items to be completed or corrected before final payment.
2. The Engineer shall consider any objections made by the County as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the County a definite Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

A. When the Contractor considered the work to be complete, he shall submit written certification stating that:

1. The Contract Documents have been reviewed.
2. The work has been inspected for compliance with Contract Documents.
3. The work has been completed in accordance with Contract Documents.
4. The equipment and systems have been tested in the presence of the County's representative and are operational.
5. The work is completed and ready for final inspection.

B. The County shall make an inspection to verify the status of completion after receipt of such certification.

C. If the County determines that the work is incomplete or defective:

1. The County shall promptly notify the Contractor in writing, listing the incomplete or defective work.
2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to County that the work is complete.
3. The County shall reinspect the work.

D. Upon finding the work to be acceptable under the Contract Documents, the County shall request the Contractor to make closeout submittals.

E. For each additional inspection beyond a total of three (3) inspections for substantial and final completion due to the incompleteness of the work, the Contractor shall reimburse the County's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO COUNTY

A. Project Record Documents (prior to substantial completion).

B. Operation and maintenance manuals (prior to substantial completion).

C. Warranties and Bonds.

D. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.

E. Certification letter from Florida Department of Transportation and Manatee County Department of Transportation, as applicable.

F. Certificate of Insurance for Products and Completed Operations.

G. Final Reconciliation, Warranty Period Declaration, and Contractor's Affidavit (Manatee County Project Management Form PMD-9).

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the County.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:
   a. Previous Change Orders
   b. Unit Prices
   c. Penalties and Bonuses
   d. Deductions for Liquidated Damages
   e. Other Adjustments
3. Total Contract Sum, as adjusted.
4. Previous payments.

5. Sum remaining due.

C. Project Management shall prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01710 CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Execute cleaning during progress of the work and at completion of the work, as required by the General Conditions.

1.02 DISPOSAL REQUIREMENTS

Conduct cleaning and disposal operations to comply with all Federal, State and Local codes, ordinances, regulations and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulation of waste materials, rubbish and wind-blown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

C. Prior to final completion or County occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720 PROJECT RECORD DOCUMENTS

PART 1 STANDARDS

1.01 MINIMUM RECORD DRAWING STANDARDS FOR ALL RECORD DRAWINGS SUBMITTED TO MANATEE COUNTY

A. Record drawings shall be submitted to at least the level of detail in the contract documents. It is anticipated that the original contract documents shall serve as at least a background for all record information. Original drawings in CAD format may be requested of the County.

B. Drawings shall meet the criteria of paragraph 2.04 D above and as mentioned in Section 1.14 Record Drawings in the Manatee County Public Works Standards, Part I Utilities Standards Manual approved June 2015.

PART 2 STANDARDS

2.01 REQUIREMENTS INCLUDED

A. Contractor shall maintain at the site for the County one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. County's field orders or written instructions.
6. Approved shop drawings, working drawings and samples.
7. Field test records.
8. Construction photographs.

2.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the County.

2.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the County.

2.04 RECORDING DRAWINGS PREPARATION

A. Record information concurrently with construction progress.

B. Do not conceal any work until required information is recorded.

C. Drawings; Legibly mark to record actual construction:

1. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc. Locations of drainage ditches, swales, water lines and force mains shall be shown every 200 feet (measured along the centerline) or alternate lot lines, whichever is closer. Dimensions at these locations shall indicate distance from centerline of right-of-way to the facility.
2. Field changes of dimension and detail.
3. Changes made by Field Order or by Change Order.
4. Details not on original contract drawings.
5. Equipment and piping relocations.
6. Locations of all valves, fire hydrants, manholes, water and sewer services, water and force main fittings, underdrain cleanouts, catch basins, junction boxes and any other structures located in the right-of-way or easement, shall be located by elevation and by station and offset based on intersection P.I.'s and centerline of right-of-way. For facilities located on private roads, the dimensioning shall be from centerline of paving or another readily visible baseline.
7. Elevations shall be provided for all manhole rim and inverts; junction box rim and inverts; catch basin rim and inverts; and baffle, weir and invert elevations in control structures. Elevations shall also be provided at the PVI's and at every other lot line or 200 feet, whichever is less, of drainage swales and ditches. Bench marks and elevation datum shall be indicated.
8. Slopes for pipes and ditches shall be recalculated, based on actual field measured distances, elevations, pipe sizes, and type shown. Cross section of drainage ditches and swales shall be verified.
9. Centerline of roads shall be tied to right-of-way lines. Elevation of roadway centerline shall be given at PVI's and at all intersections.
10. Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.
11. Sidewalks, fences and walls, if installed at the time of initial record drawing submittal, shall be located every 200 feet or alternate lot lines, whichever is closer. Dimensions shall include distance from the right-of-way line and the back of curb and lot line or easement line.
12. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televiewing of the sewer following installation.
13. Elevations shall be provided on the top of operating nuts for all water and force main valves.
14. Allowable tolerance shall be ± 6.0 inches for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of ± 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of ± 2 inch.
15. Properly prepared record drawings on mylar, together with two copies, shall be certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor, and submitted to the County.

D. Specifications and Addenda; Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Changes made by field order or by change order.

E. Shop Drawings (after final review and approval):

1. Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

2.05 SUBMITTAL

A. Prior to substantial completion and prior to starting the bacteria testing of water lines, deliver signed and sealed Record Documents and Record Drawings to the County. These will be reviewed and verified by the inspector. If there are any required changes or additions, these shall be completed and the entire signed and sealed set resubmitted prior to final pay application.

B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings. Record drawings shall be certified by the professional(s) (Engineer or Surveyor licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and sealed paper drawings, signed and dated mylar drawings together with an AutoCAD version on a recordable compact disk (CD).

C. The CD shall contain media in AutoCad Version 2004 or later, or in any other CAD program compatible with AutoCad in DWG or DXF form. All fonts, line types, shape files, external references, or other pertinent information used in the drawing and not normally included in AutoCad shall be included on the media with a text file or attached noted as to its relevance and use.

D. Accompany submittal with transmittal letter, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

Note: The data required to properly prepare these record drawings shall be obtained at the site, at no cost to the County by the responsible design professional or his/her duly appointed representative. The appointed representative shall be a qualified employee of the responsible design professional or a qualified inspector retained by the responsible design professional on a project-by-project basis.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01730 OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile product data and related information appropriate for County's maintenance and operation of products furnished under Contract.

Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

B. Instruct County's personnel in maintenance of products and equipment and systems.

C. Provide three (3) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.02 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by County's personnel.

B. Format:

1. Size: 8-1/2 inch x 11 inch
2. Paper: 20 pound minimum, white, for typed pages
3. Text: Manufacturer's printed data or neatly typewritten
4. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to size of text pages.
5. Provide fly-leaf for each separate product or each piece of operating equipment.
   a. Provide typed description of product and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
   a. Title of Project.
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.
2. Maximum ring size: 1 inch.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.03 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.
   a. Function, normal operating characteristics and limiting conditions.

b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of replaceable parts.

2. Operating Procedures:
   a. Start-up, break-in, routine and normal operating instructions.
   b. Regulation, control, stopping, shut-down and emergency instructions.
   c. Summer and winter operating instructions.
   d. Special operating instructions.
3. Maintenance Procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Alignment, adjusting and checking.
4. Servicing and lubricating schedule.
   a. List of lubricants required.
5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
   a. List of predicted parts subject to wear.
   b. Items recommended to be stocked as spare parts.
8. As installed control diagrams by controls manufacturer.
9. Each contractor's coordination drawings.
   a. As installed color coded piping diagrams.
10. Charts of valve tag numbers, with location and function of each valve.
11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
12. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.
   a. Function, normal operating characteristics and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
2. Circuit directories of panelboards.
   a. Electrical service.
      b. Controls.
   c. Communications.
3. As-installed color coded wiring diagrams.
4. Operating procedures:
   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.
5. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Adjustment and checking.
6. Manufacturer's printed operating and maintenance instructions.
7. List of original manufacture's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
8. Prepare and include additional data when the need for such data becomes apparent during instruction of County's personnel.

D. Prepare and include additional data when the need for such data becomes apparent during instruction on County's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.04 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form fifteen days prior to substantial completion.

1. Copy will be returned after substantial completion, with comments (if any).

B. Submit two copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.05 INSTRUCTION OF COUNTY'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct County's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01740 WARRANTIES AND BONDS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to County for review and transmittal.

1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for County's personnel:
   a. Proper procedure in case of failure.
   b. Instances which might affect the validity of warranty or bond.
7. Contractor, name of responsible principal, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inch x 11 inch punched sheets for standard 3-ring binder. Fold larger sheets to fit into binders.
2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
   a. Title of Project.
   b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. Make submittals within ten days after date of substantial completion and prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.

B. Approval by the County of all documents required under this section is a pre-requisite to requesting a final inspection and final payment

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01900 STRUCTURAL DESIGN AND ANCHORAGE REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. SCOPE

This section specifies the minimum structural requirements for the design, anchorage and bracing of architectural/mechanical/HVAC/electrical components, equipment, and systems, and non-building structures. Design of supports, attachments and bracing for all parts or elements of the architectural, mechanical, HVAC and electrical systems shall be provided in accordance with this section. The requirements of this section shall apply to the design of the structural elements and features of equipment and to platforms/walkways that are provided with equipment or non-building structures.

This section applies to nonstructural components that are permanently attached to structures, and non-building structures as defined below in paragraph 1.01-B and ASCE 7-10. Note that equipment is defined as a non-structural component and tanks are defined as a non-building structure.

Design shall be in accordance with the criteria listed within this section and shall conform to the provisions of the design codes listed within this section. Engineering design is not required for attachments, anchorage, or bracing detailed on the drawings or where the size of attachments, anchorage, or bracing is defined in the technical specification sections.

B. DEFINITIONS:

1. STRUCTURES: The structural elements of a building that resist gravity, wind, and other types of loads. Structural components include columns, posts, beams, girders, joists, bracing, floor or roof sheathing, slabs or decking, load-bearing walls, and foundations.

2. NONSTRUCTURAL COMPONENTS: The nonstructural portions of a building include every part of the building and all its contents, except the structural portions, that carry gravity loads and that may also be required to resist the effects of wind, impact, and temperature loads. Nonstructural components include, but are not limited to, ceilings, partitions, windows, equipment, piping, ductwork, furnishings, lights, etc.

3. NONBUILDING STRUCTURES: All self-supporting structures that carry gravity loads and that may also be required to resist the effects of wind, impact, and temperature loads. No building structures include, but are not limited to, pipe racks, storage racks, stacks, tanks, vessels and structural towers that support tanks and vessels.

1.02 QUALITY ASSURANCE

A. QUALITY CONTROL BY THE COUNTY:

Special Inspection of nonstructural components and non-building structures, and their anchorages shall be performed by the Special Inspector under contract with the County and in conformance with the 2014 Florida Building Code. Special Inspector(s) and laboratory shall be acceptable to the County in their sole discretion. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.

B. REFERENCES:

Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization, or if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced. When conflicting requirements occur, the most stringent requirements will govern the design.

Reference	Title
AAMA	American Architectural Manufacturer's Association
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 360	Specification for Structural Steel Buildings
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASTM C635	Standard Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636	Standard Practice for Installation for Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.2	Structural Welding Code – Stainless Steel
FBC	Florida Building Code with local amendments
NFPA-13	Standard for the Installation of Sprinkler Systems
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration

1.03 SUBMITTALS

For structural elements of nonstructural components and non-building structures required to be designed per this specification section, drawings and design calculations shall be stamped by a Florida licensed professional engineer qualified to perform structural engineering.

Submit drawings and calculations no less than four weeks in advance of the installation of any component to be anchored to the structure or installation of any structural member to which the component will be attached.

A. The following submittals shall be provided in accordance with Section 01300:

1. List of all nonstructural components and non-building structures requiring wind design and anchorage.

2. Shop drawings showing details of complete wind bracing and anchorage attachment assemblies including connection hardware, and embedment into concrete.

3. Shop drawings showing plans, elevations, sections and details of equipment support structures and non-building structures, including anchor bolts, structural members, platforms, stairs, ladders, and related attachments.

4. Identify all interface points with supporting structures or foundations, as well as the size, location, and grip of all required attachments and anchor bolts. Clearly indicate who will be providing each type of attachment/anchor bolt. Equipment vendor shall design anchor bolts, including embedment into concrete, and submit stamped calculations.

5. Calculations for all supports, bracing, and attachments shall clearly indicate the design criteria applied in the design calculations. Concrete embedment calculations shall be coordinated with thickness and strength of concrete members. Submit a tabulation of the magnitude of unfactored (service level) equipment loads at each support point, broken down by type of loading (dead, live, wind, etc.). Indicate impact factors applied to these loads in the design calculations.

6. Product Data: Manufacturer's certificates of compliance with the loading requirements of this section.

1.04 DESIGN CODES

The following standard codes have application at this site for:

Buildings/Structures:	Florida Building Code 2014 and ASCE 7-10
Reinforced concrete:	ACI 350-06 for Concrete Liquid Containing Tanks, ACI 318-11 for all other reinforced concrete
Structural steel:	AISC 360-10
Welding:	AWS Welding Codes, Latest Edition

Occupational health and safety requirements:	U.S. Dept. of Labor, Occupational Safety and Health Administration (OSHA)

When conflicting requirements occur, the most stringent requirements will govern the design.

1.05 DESIGN LOADS

All nonstructural components and non-building structures shall be designed for the following loads. Wind and snow loads shall not be applied to nonstructural components and non-building structures that are located inside buildings.

A. DEAD LOADS:

An additional allowance will also be added for piping and conduit when supported and hung from the underside of equipment and platforms.

Typical allowance for piping and conduit unless noted otherwise: 20 psf

B. UNIFORM LIVE LOADS:

Elevated grating floors:	100 psf
Columns:	No column live load reduction allowed
Stairs and landings:	100 psf
Equipment platforms, walkways/catwalks (other than exitways):	100 psf
Utility bridges:	75 psf per level minimum

C. WIND LOADS:

Code:	FBC 2014 & ASCE 7-10
Ultimate Wind Speed (3-second gust):	160mph
Exposure:	C
Topographic Factor (K_{zt})	1.0

All exterior non-structural components and non-building structures, unless located in a pit or basin, shall be designed to withstand the design wind loads without consideration of shielding effects by other structures.

D. IMPACT LOADS:

Impact loads shall be considered in the design of support systems.

The following impact load factors shall be used unless recommendations of the equipment manufacturer will cause a more severe load case.

Rotating machinery:	20% of moving load
Reciprocating machinery:	50% of moving load
Monorail Hoists:	
Vertical	25% of lifted load
Longitudinal	10% of lifted load
Hangers supporting floors and platforms:	33% of live and dead load

E. TEMPERATURE:

The effects of temperature shall be included in design where nonstructural components and non-building structures are exposed to differential climatic conditions. See Section 1.07 for temperature extremes.

1.06 LOAD COMBINATIONS

All nonstructural components and non-building structures shall be designed to withstand the load combinations as specified in the governing building code. Where the exclusion of live load or impact load would cause a more severe load condition for the member under investigation, then the load shall be ignored when evaluating that member.

1.07 DESIGN CONSIDERATIONS

All nonstructural components and non-building structures shall be designed for the following conditions:

A. CLIMATIC CONDITIONS:

Maximum design temperature:	100	degrees Fahrenheit
Minimum design temperature:	15	degrees Fahrenheit

B. FOUNDATIONS:

Foundations supporting nonstructural components and non-building structures shall extend below grade a minimum of 12".

Consult project geotechnical report for allowable soil bearing recommendations at location of structure.

1.08 COLUMN BASE FIXITY

Column bases shall be designed as pinned connections. No moments shall be assumed to be transferred to the foundations.

Where significant shear loads (greater than 5,000 lb. per anchor bolt) are transferred at column base plates, the equipment vendor shall provide a shear key.

1.09 DEFLECTIONS

Maximum beam deflections as a fraction of span for walkways and platforms shall be L/240 for total load and L/360 for live load. Maximum total load deflection for equipment supports shall be L/450.

PART 2 PRODUCTS

2.01 GENERAL

Materials shall be in conformance with information shown on the drawings and in other technical specification sections. See individual component and equipment specifications for additional requirements.

PART 3 EXECUTION

3.01 GENERAL

A. Attachments and braces shall be made in such a manner that the component force is transferred to the lateral force-resisting system of the structure. Attachment requirements and size and number of braces shall be based on the calculations submitted by the Contractor.

B. All anchorage of equipment is specified to be made by cast-in anchor bolts in concrete elements unless specifically noted otherwise on the drawings or other specification Sections. Contractor shall be responsible for any remedial work or strengthening of concrete elements because of superimposed loading if anchor bolts are improperly installed or omitted due to lack of submittal review or improper placement for any reason, at no additional cost to the County.

C. Anchor bolts shall be provided and installed by the Contractor in accordance with Section 05501. Size of anchor bolts and embedment of anchor bolts shall be based on the calculations submitted by the Contractor.

D. Details of and calculations for all anchorages shall be submitted and accepted in accordance with paragraph 1.03 prior to placement of concrete or erection of other structural supporting members. Submittals received after structural supports are in place will be rejected if proposed anchorage method would create an overstressed condition of the supporting member. The Contractor shall be responsible for revisions to the anchorages and/or strengthening of the structural support so that there is no overstressed condition at no additional cost to the County.

END OF SECTION

SECTION 01999 REFERENCE FORMS

The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01040-A	Maintenance of Plant Operations (MOPO) Form
01300-A	Submittal Transmittal Form
01660-A	Equipment Test Report Form
01730-A	Operation and Maintenance Transmittal Form
01730-B	Equipment Record Form
01730-C	Equipment Record Form
09900-A	Coating System Inspection Checklist
11000-A	Manufacturer's Installation Certification Form
11000-B	Manufacturer's Instruction Certification Form
11000-C	Unit Responsibility Certification Form
11002-A	Rigid Equipment Mount Installation Inspection Checklist
11060-A	Motor Data Form
15000-A	Lubrication Record
15000-B	Alignment Record
15000-C	Inspection Report Fan/Blower
15000-D	Mechanical Equipment Data Record
15000-E	Final Tank and Vessel Inspection
15000-F	Piping Inspection Report
15000-G	Pressure Test Report
15000-H	Heat Trace Record
15000-I	System Flush Record
16000-A	Wire and Cable Resistance Test Data Form
16000-B	Installed Motor Test Data Form
16000-C	Dry Transformer Test Data Form
16000-D	Motor Control Center Test Form
16000-E	Medium Voltage Motor Starter Test Form
16000-F	Medium Voltage Switchgear Test Form
16000-G	Protective Relay Test Form
16000-H	Low Voltage Switchgear Test Form
16000-I	Medium Voltage Load Interrupter Switch Test Form
16000-J	Liquid-Filled Transformer Test Form
16000-K	Automatic Transfer Switch Test Form
16000-L	Neutral Grounding Resistor Test
17000-A	Loop Wiring and Insulation Resistance Test Data Form
17000-B	Control Circuit Piping Leak Test Form
17000-C	Controller Calibration Test Data Form
17000-D	Panel Indicator Calibration Test Data Form
17000-E	Recorder Calibration Test Data Form

Form No.	Title
17000-F	Signal Trip Calibration Test Data Form
17000-G	Field Switch Calibration Test Data Form
17000-H	Transmitter Calibration Test Data Form
17000-I	Miscellaneous Instrument Calibration Test Data Form
17000-J	Individual Loop Test Data Form
17000-K	Loop Commissioning Test Data Form

01040 – A – MAINTENANCE OF PLANT OPERATIONS

MOPO Title: _____

ITEM NO.	ITEM DESCRIPTION	PROCESS UNITS OPERATING PRIOR TO SHUTDOWN	PROCESS UNITS OPERATING DURING SHUTDOWN	PROCESS UNITS OUT-OF-SERVICE DURING SHUTDOWN	IMPACT ON OTHER PROCESS UNITS	PROCEDURE	CONSTRAINTS AND REMARKS	DURATION OF SHUTDOWN

SUBMITTAL TRANSMITTAL

Submittal Description: _____ Submittal No:[1] _____

Spec Section: _____

	Routing	Sent	Received
CITY:	Contractor/CM		
PROJECT:	CM/Engineer		
	Engineer/CM		
CONTRACTOR:	CM/Contractor		

We are sending you ☐ Attached ☐ Under separate cover via _____
☐ Submittals for review and comment ☐ Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action[a]	Reviewer initials	Review comments attached

[a]**Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected**
Attach additional sheets if necessary.

Contractor

Certify either A or B:

☐ A. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).

☐ B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____
Contractor's Signature

[1]See paragraph 01300-4.0 A, Transmittal Procedure.

01660-A. EQUIPMENT TEST REPORT FORM

NOTE: This example equipment test report is provided for the benefit of the Contractor and is not specific to any piece of equipment to be installed as a part of this project. The example is furnished as a means of illustrating the level of detail required for the preparation of equipment test report forms for this project.

CITY OF SAMPLE

EXAMPLE WATER TREATMENT PLANT
STAGE IV EXPANSION PROJECT

ABC Construction Company, Inc., General Contractor
XYZ Engineering, Inc., Engineer

EQUIPMENT TEST REPORT

Equipment Name: Sludge Feed Pump 2
Equipment Number: P25202
Specification Ref: 11390
Location: East Sedimentation Basin Gallery

	Contractor		Engineer	
	Verified	Date	Verified	Date
PREOPERATIONAL CHECKLIST				
Mechanical				
Lubrication				
Alignment				
Anchor bolts				
Seal water system operational				
Equipment rotates freely				
Safety guards				
Valves operational				
Hopper purge systems operational				
Sedimentation tank/hopper clean				
O&M manual information complete				
Manufacturer's installation certificate complete				
Electrical (circuit ring-out and high-pot tests)				
Circuits:				
Power to MCC 5				
Control to HOA				
Indicators at MCC:				
Red (running)				
Green (power)				
Amber (auto)				

	Contractor		Engineer	
	Verified	Date	Verified	Date
Indicators at local control panel				
Wiring labels complete				
Nameplates:				
MCC				
Control station				
Control panel				
Equipment bumped for rotation				
Piping Systems				
Cleaned and flushed:				
Suction				
Discharge				
Pressure tests				
Temporary piping screens in place				
Instrumentation and Controls				
Flowmeter FE2502F calibration				
Calibration Report No.				
Flow recorder FR2502G calibrated against transmitter				
VFD speed indicator calibrated against independent reference				
Discharge overpressure shutdown switch calibration				
Simulate discharge overpressure Shutdown				
FUNCTIONAL TESTS				
Mechanical				
Motor operation temperature satisfactory				
Pump operating temperature satisfactory				
Unusual noise, etc.?				
Pump operation: 75 gpm/50 psig				
Measurement:				
Flow:				
Pressure:		Test gage number:		
Alignment hot				
Dowelled in				
Remarks:				

	Contractor		Engineer	
	Verified	Date	Verified	Date
Electrical				
Local switch function:				

Runs in *HAND*				
No control power in *OFF*				
Timer control in *AUTO*				
Overpressure protection switch PS2502C functional in both *HAND* and *AUTO*				
Overpressure protection switch PS2502C set at 75 psig				
PLC 2500 set at 24-hour cycle, 25 min *ON*				
OPERATIONAL TEST				
48-hour continuous test. Pump cycles as specified, indicators functional, controls functional, pump maintains capacity, overpressure protection remains functional, hour meter functional				

RECOMMENDED FOR BENEFICIAL OCCUPANCY

_____ _____

Engineer _____ Date _____

ACCEPTED FOR BENEFICIAL OCCUPANCY

_____ _____

City's Representative_____ Date _____

01730-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date: _____ Submittal No:[2] _____

To: _____ Contract No: _____

_____ Spec. Section: _____

_____ Submittal Description: _____

_____ From: _____

Attention: _____ _____

Checklist	Contractor		Engineer	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and post shutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks: _____

Contractor's Signature

[2]See paragraph 01300-4.0 A, Transmittal Procedure.

Manatee County, FL

01730-B. EQUIPMENT RECORD FORM

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours
LUBRICANTS: RECOMMENDED:							
ALTERNATIVE:							
MISC. NOTES:							

RECOMMENDED SPARE PARTS			
PART NO	QUAN	PART NAME	COST

ELECTRICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	V	AMP	HZ
PH	RPM	SF	DUTY
CODE	INSL. CL	DES	TYPE
NEMA DES	C AMB	TEMP RISE	RATING
MISC.			
MECHANICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	RPM	CAP	SIZE
TDH	IMP SZ	BELT NO.	CFM
PSI	ASSY NO.	CASE NO.	
MISC			

01730-C. EQUIPMENT RECORD FORM

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours

09900-A COATING SYSTEM INSPECTION CHECKLIST

09900-A Coating System Inspection Checklist			
Project Name			
City		Coating System Manufacturer (CSM)	
General Contractor (GC)		Coating System Applicator (CSA)	
Area or Structure		Location within Structure	
Coating System (e.g. E-1)		Coating Type (e.g. Epoxy, etc.)	

Step	Description		Name	Signature	Date
1	Completion of cleaning and substrate decontamination prior to abrasive blast cleaning.	GC QC			
		CSM QC			
		CSA QC			
2	Installation of protective enclosure of structure or area and protection of adjacent surfaces or structures that are not to be coated.	GC QC			
		CSM QC			
		CSA QC			
3	Completion of ambient condition control in structure or building area and acceptance of ventilation methods in structure or Area.	GC QC			
		CSM QC			
		CSA QC			
4	Completion of Surface Preparation for Substrates to Be Coated.	GC QC			
		CSM QC			
		CSA QC			
5	Completion of Primer Application.	GC QC			
		CSM QC			
		CSA QC			
6	Completion of Concrete Repairs If Required and Related Surface Preparation Rework Prior to Coating System Application.	GC QC			
		CSM QC			
		CSA QC			
7	Completion of Concrete Filler/ Surface	GC QC			

Step	Description		Name	Signature	Date
	Application to Concrete.	CSM QC			
		CSA QC			
8	Completion of First Finish Coat Application and of Detail Treatment at Transitions or Terminations.	GC QC			
		CSM QC			
		CSA QC			
9	Completion of Second Finish Coat Application and of Detail Treatment at Transitions and Terminations.	GC QC			
		CSM QC			
		CSA QC			
10	Completion of Full and Proper Cure of Coating System.	GC QC			
		CSM QC			
		CSA QC			
11	Completion of Testing of Cured Coating System including Adhesion, Holiday (Continuity) Testing and Dry Film Thickness.	GC QC			
		CSM QC			
		CSA QC			
12	Completion of Localized Repairs to Coating System Following Testing.	GC QC			
		CSM QC			
		CSA QC			
13	Final Acceptance of Coating System Installation Including Final Clean-Up Complying with Specification Requirements and the CSM's Quality Requirements.	GC QC			
		CSM QC			
		CSA QC			

11000-A. MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No: _____ Specification section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments: _____

_____

_____

_____

_____

_____ _____

Date Manufacturer

_____

Signature of Authorized Representative

_____ _____

Date Contractor

_____

Signature of Authorized Representative

11000-B. MANUFACTURER'S INSTRUCTION CERTIFICATION FORM

Contract No: _____ Specification section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer certifies that a service engineer has instructed the wastewater treatment plant operating personnel in the proper maintenance and operation of the equipment designated herein.

Operations Check List (check appropriate spaces)	
Start-up procedure reviewed	
Shutdown procedure reviewed	
Normal operation procedure reviewed	
Others:	
Maintenance Check List (check appropriate spaces)	
Described normal oil changes (frequency)	
Described special tools required	
Described normal items to be reviewed for wear	
Described preventive maintenance instructions	
Described greasing frequency	
Others:	

_____ _____
Date Manufacturer

_____
Signature of Authorized Representative

_____ _____
Date Signature of City's Representative

_____ _____
Date Signature of Contractor's Representative

(Project Title)

CERTIFICATE OF UNIT RESPONSIBILITY
for Specification Section _____

_____
(Section title)

In accordance with paragraph 11000-1.02 C of the contract documents, the undersigned manufacturer of driven equipment ("manufacturer") accepts unit responsibility for all components of equipment furnished to the Project under specification Section_____ ,_and for related equipment manufactured under Sections_____, _____, and _____ .

We have reviewed the requirements for Sections 11000 (and 11050 where applicable) and all sections referencing this (these) section(s), including but not limited to drivers, supports for driving and driven equipment and all other specified appurtenances to be furnished to the Project by manufacturer. And, we have further reviewed, and modified as necessary, the requirements for associated variable speed drives and motor control centers. We hereby certify that all specified components are compatible and comprise a functional unit suitable for the specified performance and design requirements whether or not the equipment was furnished by us. We will make no claim nor establish any condition that problems in operation for the product provided under this specification Section _____ are due to incompatibility of any components covered by this Certificate of Unit Responsibility. Nor will we condition or void any warranty for the performance of the product of this specification Section _____ due to incompatibility of any components covered under this Certificate of Unit Responsibility.

Our signature on this Certificate of Unit Responsibility does not obligate us to take responsibility for, nor to warrant the workmanship, quality, or performance of related equipment provided by others under specification Sections _____, _____, and _____. Our obligation to warranty all equipment provided by us shall remain unaffected.

_____
Notary Public

_____
Commission expiration date

Seal:

_____
Name of Corporation

_____
Address

By: _____
Duly Authorized Official

_____
Legal Title of Official

Date: _____

11002-A. RIGID EQUIPMENT MOUNT INSTALLATION CHECKLIST

(CLIENT, PROJECT NAME)

Equipment Tag No.: _____ Date: _____

Grout Product Name and Type: _____

Grouting System Manufacturer: _____

Grouting Application Contractor: _____

General Contractor: _____

Step 1: Verify Equipment Anchor Installation Conformance to Equipment Pad Details

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Name: _____
Engineer Millwright

Step 2: Completion of Cleaning and Concrete Substrate Preparation Prior to Grouting

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Name: _____
Engineer Grouting Contractor Rep.

Name: _____
Grout Manufacturer's Technical Rep.

Step 3: Equipment Leveling

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Name: _____
Engineer Millwright

Step 4: Installation of Protection of Adjacent Surfaces or Structures NOT TO BE GROUTED

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Name: _____
Engineer Grouting Contractor Rep.

Name: _____
Grout Manufacturer's Technical Rep.

Step 5: Preparation and Construction of Forms and Epoxy Grout Filling Standpipes

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Name: _____
Engineer Grouting Contractor Rep.

Name: _____
Grout Manufacturer's Technical Rep.

Step 6: Completion of Ambient Condition Control in Structure or Building Area and Acceptance of Ambient Conditions as They Apply to Application and Curing Requirements for the Grouting System

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Date___/___/___
Grouting Contractor Rep.

Name: _____ Date___/___/___
Grout Manufacturer's Technical Rep.

Name: _____ Date___/___/___
Engineer

Step 7: Epoxy Grout Installation

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Name: _____
Engineer Grouting Contractor Rep.

Name: _____
Grout Manufacturer's Technical Rep.

Step 8: Completion of Full and Proper Cure of Epoxy Grout

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Date___/___/___
Grouting Contractor Rep.

Name: _____ Date___/___/___
Grout Manufacturer's Technical Rep.

Name: _____ Date___/___/___
Engineer

Step 9: Completion of Localized Repair of Grout Voids

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Date___/___/___
Grouting Contractor Rep.

Name: _____ Date___/___/___
Grout Manufacturer's Technical Rep.

Name: _____ Date___/___/___
Engineer

Step 10: Final Acceptance of Grouting System Installation Including Final Clean-Up of the Work Site Complying with All Specification Requirements and the GSM's Quality Requirements

Name: _____ Date___/___/___
Contractor Rep.

Name: _____ Date___/___/___
Grouting Contractor Rep.

Name: _____ Date___/___/___
Grout Manufacturer's Technical Rep.

Name: _____ Date___/___/___
Engineer

11060-A. MOTOR DATA FORM

Equipment Name: _____ Equipment No(s): _____

Project Site Location: _____

Nameplate Markings

Mfr:		Mfr Model:		Frame:		Horsepower:	
Volts:		Phase:		RPM:		Service Factor:	
FLA:		LRA:		Frequency:		Amb Temp Rating:	ºC

Time rating:	(NEMA MG1-10.35)	Design Letter:	(NEMA MG-1.16)
KVA Code Letter:		Insulation Class:	

The following information is required for explosion-proof motors only:

A. Approved by UL for installation in Class _____, Div _____, Group _____

B. UL frame temperature code ____ (NEC Tables 500-8B)

The following information is required for all motors 1/2 horsepower and larger:

A. Guaranteed minimum efficiency _____
(Paragraph 11060-2.04 G)

B. Nameplate or nominal efficiency _____

Data Not Necessarily Marked on Nameplate

Type of Enclosure:			Enclosure Material:		
Temp Rise:	ºC (NEMA MG1-12.41,42)				
Space Heater included?	☐ Yes	☐ No	If Yes:	Watts	Volts
Type of motor winding over-temperature protection, if specified:					

Provide information on other motor features specified:

_____

15000-A. LUBRICATION RECORD

Description:		TAG:	
System:		P&ID:	
	Driven Equipment	**_____Coupling _____Chain**	**Driver Equipment**
Grease Manufacturer			
Grease Type			
Oil Manufacturer			
Factory Lubed (Inspected)			
Date Lubricated			
Tag Installed			
Lube Quantity			

Additional Checks and Remarks as Required
(Inspection frequencies and items which require special maintenance)

Approved by: _____ Dept: _____ Date: _____

Performed by: _____ Dept: _____ Date: _____

15000-B. ALIGNMENT RECORD

Description:	TAG:
System:	P&ID:

Equipment Data	Driven	Driver
Manufacturer		
Serial Number		
Tag Number		
Sheave Alignment (Belt or chain driven)		
Pipe Strain Values (If applicable)		

FACE	OUTSIDE DIAMETER

Viewed from Driver End

Manufacturer's Tolerance:

FACE: _____ CD: _____GAP: _____

Remarks:

Performed by: _____ Dept: _____ Date: _____

Approved by: _____ Dept: _____ Date: _____

15000-C. INSPECTION REPORT FAN/BLOWER

Description:	TAG:
System:	P&ID:
Manufacturer	S/N
Type	Model
Size	Capacity
RPM	

Equipment Test Data

Bearing Temperatures: Inboard: _____ Outboard: _____	Measured RPM
Rotation Viewed from Motor End CW CCW	Motor AMPS (At Test Condition)

Vibration Data (Draw arrows where taken)

Points	A	B	C	D	E
Horiz.					
Vert.					
Axial					

Units of Measure: _____ **Sketch of Equipment**

Fan Data:

MFG.	Fan Size	Blade Pitch Angle
S/N	Fan Type	Motor HP
M/N		

Completeness Checklist:

Alignment	Date:	Initials:
Drive Guard	Date:	Initials:
Shaft Free to Rotate	Date:	Initials:
Blower Lobe Clearance	Date:	Initials:
Balance	Date:	Initials:

Remarks:

Approved by: _____ Dept: _____ Date: _____

Performed by: _____ Dept: _____ Date: _____

15000-D. MECHANICAL EQUIPMENT DATA RECORD

Description:	TAG:
System:	P&ID:

Name Plate Data: (Driven equipment)
see motor acceptance for motor information.

Manufacturer	S/N
Type	Model
Size	Capacity
RPM	

Equipment Test Data

Suction Pressure	Suction Temperature
Discharge Pressure	Discharge Temperature
Bearing Temperatures: Inboard: _____ Outboard: _____	Measured RPM
Rotation Viewed from Motor End CW CCW	Motor AMPS (At Test Condition)

Vibration Data (Draw arrows where taken)

Points	A	B	C	D	E
Horiz.					
Vert.					
Axial					

Units of Measure: _____

Sketch of Equipment

Remarks:

Performed by: _____ **Date** _____

Approved by: _____ **Date** _____

15000-E. FINAL TANK AND VESSEL INSPECTION

Description:		TAG:
System:		P&ID:
Tank Name Plate Data		
Manufacturer		
Type		
Size/Capacity		
Design Pressure		
Inspection Items	**Verified By**	**Date**
Clean		
Dry		
Grounding		
Coating		
Pipe Connections		
Cathodic Protection		
Heater Checkout		
Equipment Number		
Heater Coil	OHMS	
Thermostat Setting	Degrees	
Amperage in Service	Amps	
Remarks:		
Performed by: _____ Dept: _____ Date: _____		
Approved by: _____ Dept: _____ Date: _____		

15000-F. PIPING INSPECTION REPORT

Description: Tag:

System: P&ID:

READY FOR FINAL INSPECTION

Approved by: _____ Dept: _____ Date: _____

Verify the following as meeting the drawings and applicable piping specification. (Verification to be 100% unless otherwise noted)

[R] = Random (Approx. 10% of installed quantities)

	Item	Initials	Remarks
[R]	Material check (pipe and fittings)		
[R]	Studs / Bolts (material and type) 1-1 1/2 thread minimum protrusion from both nuts		
[R]	Gaskets (type & rating)		
[R]	Valves / in line components (Tag & Rating)		
	Welding visual		
	Nondestructive testing		
	Post weld heat treatment		
	Supports (attach verification sheets)		

Note: 100% verification required for studs, gaskets, and valves for HPS and HP feedwater systems.

Comments / Exceptions:

Released for pressure test or system turnover:

Performed by: _____ Dept: _____ Date: _____

Approved by: _____ Dept: _____ Date: _____

15000-G. PRESSURE TEST REPORT

Description:			Tag:
System:			P&ID:
Applicable Code/Section			
Above Ground			
Design Pressure:			
Test Method:	Hydrostatic	Pneumatic	In Service
Required Test Pressure:			
Inspection Test Pressure:			
Required Time Pressure Test Held:			
Time Test Started:		Time Test Completed:	
Remarks:			
Calibration Data Gauge No: _____ Calibration Date: _____			
Performed by: _____ Dept.: _____ Date: _____			
Approved by: _____ Dept.: _____ Date: _____			

15000-H. HEAT TRACE RECORD

System:

Heat Trace Circuit No.	Power Supply Panel No.	Ring Out	Hook Up	Amps	Thermostat Setpoint	Post Insul. Megger Readings	In-Service Initials/Date

Performed by: _____ Dept.: _____ Date: _____

Approved by: _____ Dept.: _____ Date: _____

15000-I. SYSTEM FLUSH REPORT

System:	P&ID:
Flushing Fluid:	
Description of Flush:	
Note: Verify that all critical piping not flushed is acceptably clear.	
Performed by: _____ Dept.: _____ Date: _____	
Approved by: _____ Dept.: _____ Date: _____	

16000-A. WIRE AND CABLE RESISTANCE TEST DATA FORM

Wire or Cable No.:_____ Temperature, °F: _____

Location of Test	Insulation resistance, megohms
1.	
2.	
3.	
4.	
5.	
6.	
7	

.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

16000-B. INSTALLED MOTOR TEST FORM

Motor Equipment Number: _____ Date of test: _____

Equipment Driven: _____

MCC Location: _____

				Ambient temp	°F
Resistance:					
Insulation resistance phase-to-ground megohms:					
Phase A		Phase B		Phase C	
Current at Full Load:					
Phase		Current, amps			
Phase		Current, amps			
Phase		Current, amps			
Thermal Overload Device:	Manufacturer/catalog #		Amperes		
Circuit breaker (MCP) setting:					

Motor Nameplate Markings:

Mfr		Mfr Model		Frame		HP	
Volts		Phase		RPM		Service factor**	
Amps		Freq		Ambient temp rating			ºC
Time rating			Design letter**				
	(NEMA 1-10.35)			(NEMA MG-1.16)			
Code letter			Insulation class				

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

16000-C. DRY TRANSFORMER TEST DATA FORM

(Note: Use Data Form for dry type transformers with voltage rating of 600 Vac or less and sizes to 167 kVA single phase and 500 kVA three phase. Use NETA Test Forms and Test Procedures for higher voltages and larger transformers.)

Equipment Tag No.: _____ Temperature Rating: _____

Description/Location: _____ Feeder size/Source: _____

Primary Voltage: _____ Secondary Voltage: _____ Winding Connection: _____

A. VISUAL INSPECTION

Transformer Inspection	Pass	Fail	Note
1. Nameplate data as specified			
2. Mechanical condition			
a. Free of dents and scratches			
b. Anchored properly			
c. Shipping brackets removed			
d. Spacing from wall per nameplate			
3. Grounding *			
a. Equipment grounding			
b. System grounding			

B. INSULATION-RESISTANCE TESTS:

Perform tests with calibrated megohmeter. Apply 1000 Vdc test voltage for 60 seconds and record readings in megohms at 30-seconds and 60-seconds intervals.

Test Group	Resistance between		30-second reading	60-second reading	Absorption Ratio Index 60-sec. / 30-sec.
Primary Winding to ground	A	GRD			
	B	GRD			
	C	GRD			
Secondary Winding to ground with * N-G Bond removed	a	GRD			
	b	GRD			
	c	GRD			
Primary Winding to Secondary Winding	A	a			
	B	b			
	C	c			

Submit resistance readings to the Engineer immediately after the tests that are less than the manufacturer's recommended value or less than 10-megohms. Record the Absorption Ratio Index values for future reference. Ratio must be 1.0 or greater, with infinity (∞) equal to 1.0.

Contractor Representative Certified: _____ Date _____

City Representative Witnessed:_____ Date _____

16000-D. MOTOR CONTROL CENTER TEST FORM

Equipment No.: _____ Ambient room temperature: _____

Location: _____

A. MECHANICAL CHECK:

All bolted connections either bus to bus or cable to bus shall be torqued to the manufacturer's recommendations.

B. ELECTRICAL TESTS:

1. Measure insulation resistance of each bus section phase to phase and phase to ground for 1 minute using a megohmmeter at 1000 volts.

Test results (megohms)			
Phase		Phase	
A-GRD		A-B	
B-GRD		B-C	
C-GRD		C-A	

2. Set the circuit breaker in the starter unit to comply with the requirements of NEC, Article 430-52 and Table 430-152.

3. Motor overload heater elements shall be sized and installed based on the actual nameplate full load amperes of the motor connected to the starter.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

16000-E. MEDIUM VOLTAGE MOTOR STARTER TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)

Phase:	A		B		C	

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Motor RTDs shall be tested by using a hot oil bath. The temperature at which the sensor trips shall be recorded for each RTD.

5. The Contactor shall be tripped by operation of each protective device.

16000-F. MEDIUM VOLTAGE SWITCHGEAR TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase:	A		B		C	

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Verify the instrument transformer ratios. Check the transformer's polarity electrically.

5. The Contactor shall be tripped by operation of each protective device.

16000-G. PROTECTIVE RELAY TEST FORM

Location: _____

Switchgear Breaker No.: _____

Protective Relay Description: _____

The protective relays shall be tested in the following manner:

1. Each protective relay circuit shall have its insulation resistance tested to ground.

2. Perform the following tests on the specified relay setting:

   a. Pickup parameters on each operating element.

   b Timing test shall be performed at three points on the time dial curve.

   c. Pickup target and seal-in units.

The results shall be recorded and signed. A copy shall be given to the Engineer in accordance with paragraph 16000-1.05 B.

16000-H. LOW VOLTAGE SWITCHGEAR TEST FORM

Equipment No.: _____

Location: _____

Room Temperature: _____

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms).

Phase:	A		B		C	

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

3. Minimum pickup current shall be determined by primary current injection.

4. Long time delay shall be determined by primary injection at three hundred percent (300%) pickup current.

5. Short time pickup and time delay shall be determined by primary injection of current.

6. Instantaneous pickup current shall be determined by primary injection.

7. Trip unit reset characteristics shall be verified.

8. Auxiliary protective devices, such as ground fault or under voltage relays, shall be activated to ensure operation of shunt trip devices.

16000-I. MEDIUM VOLTAGE LOAD INTERRUPTER SWITCH TEST FORM

Equipment Number: _____

Location: _____

Date: _____

1. Measure switch blade resistance (micro-ohms).

Phase:	A		B		C	

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

Phase	A		B		C		
Pole to ground							megohms
Across open pole							megohms
Pole to pole	AB		BC		CA		megohms

The results shall be recorded and signed. A copy shall be given to the Engineer in accordance with paragraph 16000-2.06 B.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

16000-J. LIQUID-FILLED TRANSFORMER TEST FORM

Equipment Number: _____

Location: _____

Date/Weather Conditions: _____

A. Perform the "Insulation-Resistance Test" and "Dielectric Absorption Test" using Form 16000-C, Dry Transformer Test Data Form.

B. Perform an applied voltage (low frequency dielectric) test in accordance with ANSI C57.12.90, paragraph 10.5, Applied Voltage Test. Applied voltage levels shall be 75 percent of recommended factory test levels or recommended test levels of ANSI C57.12.00, Table 5.

C. Insulating oil shall be sampled and shall be laboratory tested for the following:

1. Dielectric strength.

2. Acid neutralization.

3. Interfacial tension.

4. Color.

5. Power factor.

D. Perform a turns ratio test between the windings for all tap positions.

E. The temperature and pressure switches shall be tested using a hot oil bath and air pump.

F. The results shall be recorded and signed by the Contractor and Engineer. A copy shall be given to the Engineer in accordance with paragraph 16000-2.06 D. Any readings which are abnormal to ANSI industry standards shall be reported to the Engineer.

16000-K. AUTOMATIC TRANSFER SWITCH TEST FORM

Equipment Number: _____

Location: _____

Date: _____

1. Perform an insulation resistance test (1000 volts DC for 1 minute):

Phase	A		B		C		
Pole to ground							megohms
Pole to pole	AB		BC		CA		megohms

2. Perform the following operations and initial:

   a. Manual transfer _____

   b. Loss of normal power; _____sec delay

   c. Return to normal power; _____sec delay

The results shall be recorded and signed. A copy shall be given to the Engineer in accordance with paragraph 16000-2.06 B.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

16000-L. NEUTRAL GROUNDING RESISTOR TEST

Equipment No.: _____

Location: _____

The pickup and time delay setting on the ground fault relay shall be set in accordance with Section 16431.

1. The transformer neutral insulation resistance shall be measured with and without the grounding resistor connected to insure no parallel ground paths exist.

2. The protective relay pickup current shall be determined by injecting test current into the current sensor. The pickup current should be within 10 percent of the dial setting. Record the dial setting and actual pickup tie.

3. The relay timing shall be tested by injecting 150 and 300 percent of pickup current into the current sensor. The relay timing shall be in accordance with the manufacturer's published time-current characteristic curves. Record the relay timing at 150 and 300 percent of pickup current.

4. The circuit interrupting device shall be operated by operating the relay.

The results shall be recorded and signed by the Contractor and Engineer. A copy shall be given to the Engineer in accordance with paragraph 16000-2.06 B.

17000-A. LOOP WIRING AND INSULATION RESISTANCE TEST DATA FORM

Loop No.: _____

List all wiring associated with a loop in table below. Make applicable measurements as indicated after disconnecting wiring.

Wire No.	Panel Tie	Field TB	Continuity Resistance[a]		Insulation Resistance[b]			
			Cond./ Cond.	Cond./ Shield	Shield/ Gnd.	Shield/ Cond.	Cond./ Gnd.	Shield/ Shield
A			--	(A/SH)				
B			(A/B)	--				
C			(A/C)	--				
D			(A/D)	--				
etc.								

NOTES:

a. Continuity Test. Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of ±2 ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.

b. Insulation Test. Connect one end of a 500 volt megger to the panel ground bus and the other sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-B. CONTROL CIRCUIT PIPING LEAK TEST FORM

Loop No.:_____

List tubing associated with loop in table below. Make applicable measurements after isolating any air consuming pilots from circuit.

Tube No.	Tubing Equivalent Length of 1/4-Inch Copper[a]	Test Period (seconds)	Permitted Pressure Drop (psi)[b]	Measured Pressure Drop (psi)
A				
B				
C				
D				
etc.				

NOTES:

a. Convert actual tubing and air motor volume to equivalent 1/4-inch copper tubing.

b. Pressure drop shall not exceed 1 psi per hundred feet 1/4-inch tubing per 5 seconds.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-C. CONTROLLER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____ Process Variable (PV) Scale: _____

Output: _____ Output Scale: _____

PV Scale Calibration

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

Connect output to PV for following tests:

Set Point (SP) Indicator Accuracy			Output Meter Accuracy			Controller Accuracy		
SP	PV Reading	Expected % Dev.	Actual Reading	Expected Reading	Actual % Dev.	Output	Output	% Dev.
(0%)								
(50%)								
(100%)								
% Deviation Allowed:			% Deviation Allowed:			% Deviation Allowed:		

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-D. PANEL INDICATOR CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____

Scale: _____ Range: _____

PV Scale Calibration

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-E. RECORDER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____ Chart: _____

Scale: _____ Range: _____

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-F. SIGNAL TRIP CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____

Scale: _____ Range: _____

Set Point(s): _____

After setting set point(s), run signal input through entire range and calculate deadband.

Set Point	Incr. Input Trip Point	Decr. Input Trip Point	Calc. Deadband	Required Deadband

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-G. FIELD SWITCH CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No: _____

Input: _____

Range: _____

Set Point(s): _____

Simulate process variable (flow, pressure, temperature, etc.) and set desired set point(s). Run through entire range of switch and calculate deadband.

Set Point	Incr. Input Trip Point	Decr. Input Trip Point	Calc. Deadband	Required Deadband

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-H. TRANSMITTER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____

Output: _____

Range: _____ Scale: _____

_____

Simulate process variable (flow, pressure, temperature, etc.) and measure output with appropriate meter.

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-I. MISCELLANEOUS INSTRUMENT CALIBRATION TEST DATA FORM

(For instruments not covered by any of the preceding test forms, the Contractor shall create a form containing all necessary information and calibration procedures.)

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-J. INDIVIDUAL LOOP TEST DATA FORM

Loop No.: _____

Description: (Give complete description of loop's function using tag numbers where appropriate.)

P&ID No.: (Attach copy of P&ID.)

a. Wiring tested:
(Attach test form 17000-A)

b. Instrumentation tubing/piping tested:
(Attach test form 17000-B)

c. Instruments calibrated:
(Attach test forms 17000-C through I)

d. List step-by-step procedures for testing loop parameters. Test loop with instruments, including transmitters and control valves, connected and functioning. If it is not possible to produce a real process variable, then a simulated signal may be used with the Engineer's approval.

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

17000-K. LOOP COMMISSIONING TEST DATA FORM

Loop No.: _____

a. Loop tested:
(Attach test form 17000-J)

b. Controlled or connected equipment tests confirmed:

c. Give complete description of loop's interface with process.

d. With associated equipment and process in operation, provide annotated chart trace of loop response to changes in set points for verification of performance. This chart should demonstrate 1/4-amplitude damping as output adjusts to set point change. Show set points, starting and finishing times on chart, as well as any other pertinent data.

Connect 2-pen recorder to process variable (PV) and to controller output. Use 1 inch/second chart speed.

Pen 1 - PV - Connections:

Pen 2 - Output - Connections:

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
City's Representative

END OF SECTION

SECTION 02050 DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. SCOPE

This section specifies all labor, materials, equipment, and incidentals, as shown, specified, and required for demolitions, removal and disposal work. Included, but not limited to, are demolitions and removals of existing materials, equipment, or work necessary to install the work for this Contract as shown and specified and to connect same with existing work in an approved manner. Demolition includes concrete pads, metals, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, and similar existing facilities. Contractor shall pay for all landfill disposal fees. Contractor shall conduct site visit to determine extent of work and the problems anticipated to perform the work.

The Engineer did not perform a survey of asbestos containing materials or lead based paints during the design efforts. However, the Contractor shall include in their scope a limited survey to determine if asbestos containing materials or lead based paint is present. This survey shall be performed between the period of the Notice to Proceed and the Notice to Commence. The results of this survey shall be provided to the County and shall be performed by a competent and certified specialist in this type of work. The Contractor will be required to use this information to show Manatee County the presence or the lack of asbestos containing materials and lead based paints in the demolition to be performed.

1.02 SUBMITTALS

Submittals shall be made in accordance with Section 01300. In addition, the following specific information shall be provided:

A. Contractor shall develop and submit demolition plan within 14 days of the Notice to Proceed which includes a demolition schedule and detail methods to use on each item to be demolished. The demolition plan shall take into consideration any appurtenances that are to remain in service until the proposed replacement is in installed, accepted, and operational.

B. Qualifications of firm contracted by the Contractor to perform the survey for asbestos containing materials and lead based paint.

C. Results of the survey for asbestos containing materials and lead based paint.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. All materials and equipment removed from existing site work shall become the property of Contractor, except for those items that the County chooses to salvage. All materials and equipment that the County identifies to be salvaged shall be carefully removed by Contractor so as not to be damaged and shall be cleaned and stored on or adjacent to the site in a protected place specified by the County.

B. Contractor shall dispose of all demolition materials, equipment, debris, and all other items not marked by the County to salvage, off site and in conformance with all existing applicable laws and regulations.

C. Demolished items shall not be used in backfill.

D. Use water sprinkling, temporary enclosures, and other suitable methods to limit amount of dust and dirt rising and scattering to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

3.02 DEMOLITION AND REMOVAL

A. Structures (NOT USED)

B. Pavement (NOT USED)

C. Buried Piping

Buried piping removals shall comply with applicable mechanical and civil Drawings and Specifications.

When existing underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping shall be drained (water inside the demolished pipe shall be collected and not spilled onto the ground) and removed. Contractor shall coordinate with the County for proper disposal of the drained water at the facility.

D. Electrical

Electrical removals shall comply with applicable electrical Drawings and Specifications.

3.03 SALVAGE

The County will have the right to first refusal for all salvaged materials. The Contractor may salvage for their use any equipment or material scheduled for demolition that the County does not request to be salvaged. During the course of the Work, the Engineer may determine that certain piping and valving which is scheduled for demolition may be re-used. The Contractor shall propose to the Engineer to salvage portions of the Work scheduled for demolition that in the opinion of the Contractor is reusable and good condition. The Contractor shall retain from the contract value 10% of the cost of the material salvaged as if it were purchased new; and the County shall receive a credit in the amount of 90% of the cost of the new item which did not need to be purchased. The Engineer shall have the final decision on whether a piece of equipment, valving or piping may be re-used. In the instance of re-use, the Contractor shall coat to new in accordance with Section 09900. Valving, piping and equipment submittals and purchases shall be preceded by an evaluation by the Contractor and the Engineer of the equipment, piping and valving scheduled for demolition. Any re-use of material must be subject to County approval.

3.04 ALTERATIONS AND CLOSURES (NOT USED)

Manatee County BCC

3.05 CLEAN-UP

Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste, and all debris shall be removed, and premises shall be left clean, neat and orderly.

END OF SECTION

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SECTION 02064 MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to modify, alter and/or convert existing structures as shown or specified and as required for the installation of piping, mechanical equipment and appurtenances. Existing piping and equipment shall be removed and dismantled as necessary for the performance of facility alterations in accordance with the requirements herein specified.

PART 2 PRODUCTS

A. Epoxy mortar shall be fiberglass fiber mixed with an epoxy filler.

B. Non-shrink grout shall be a sand-cement, non-metallic formulation, having a 28-day strength of 4,000 psi and 0.0 percent shrinkage per ASTM C1090.

C. Liners to be installed in existing manholes and wetwells shall be spray-applied, monolithic, reinforced urethane resin. Urethane resin-based manhole liner material shall be resistant to hydrogen sulfide gas, and other common contents found in a sanitary sewer environment.

D. Approved spray liners can be found in the Utility Approved Product List approved on Feb 2020.

PART 3 EXECUTION

3.01 GENERAL

A. Cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the construction drawings, or as necessary to complete the work as required. Dispose of surplus materials resulting from the above work in an approved manner. The work shall include all necessary cutting and bending of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.

B. Dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, cut existing pipelines for the purpose of making connections thereto.

C. Anchor bolts for equipment and structural steel to be removed shall be cut off one inch below the concrete surface. Surfaces shall then be refinished using non-shrink grout or epoxy mortar or as indicated on the construction drawings. Repairs to the interior surfaces of existing concrete structures in sanitary sewers shall be made with epoxy mortar. Repairs to be made on other existing concrete surfaces using non-shrink grout shall be made using a bonding agent such as Acrylbond by Concrete Producers Solutions or an equal approved by the County. Remove all dirt, curing compounds, sealers, paint, rust or other foreign material, and etch with muriatic acid solution. Flush with clean water and while still damp, apply a coating of the bonding agent. Place the new grout patch onto the treated area immediately.

D. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including a new valve, shall be installed. Pipe restraint devices, if required, shall also be installed as required.

E. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except with the express approval of and only to the extent approved by the County.

F. When removing materials or portions of existing utility pipelines or structures or when making openings in walls and partitions, take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, and not to damage the structures or contents by falling or flying debris. Unless otherwise approved by the County, saw-cutting, rotary core-boring, or line drilling will be required in removing material from existing concrete structures or pipes.

G. Materials and equipment removed in the course of making alterations and additions shall remain the property of the County, except that items not salvageable, as determined by the County, shall be disposed of off the work site.

H. All alterations to existing utility pipes and structures shall be done at such time and in such a manner as to comply with the approved time schedule. Before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delays.

I. All cutting of existing concrete or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these Standards covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the County or per the construction drawings.

J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.

K. Non-shrink cementatious grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown on the construction drawings. The surface to which grout is to be applied shall be wetted to facilitate good bonding.

L. Where necessary or required for the purpose of making connections; cut existing pipelines in a manner to provide an approved joint. Where required, use flanges, couplings, or adapters, all as required.

M. Provide flumes, hoses, piping, pumps and well points, and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of the work.

N. Care shall be taken not to damage any part of existing buildings or foundations or outside structures.

O. Prior to entering confined spaces in sanitary sewer structures, conduct an evaluation of the atmosphere within, in accordance with local, state, and federal regulations. Provide ventilation equipment and other equipment as required to assure safe working conditions.

3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection. A County Inspector must be present for all tie-ins for a visual inspection.

3.03 REMOVAL AND ABANDONMENT OF ASBESTOS CEMENT PIPE AND APPURTENANCES (NOT USED)

3.04 IN-PLACE GROUTING OF EXISTING PIPE (NOT USED)

3.05 SPRAY-APPLIED LINERS

A. Use a high-pressure water spray to remove all foreign material from the walls and bench of the structure. Loose or protruding masonry materials shall be removed using a hammer and chisel. Fill any voids, holes or cracks using a hand trowel with epoxy mortar to form a uniform surface. Place covers over all pipe openings to prevent extraneous material from entering the pipes. Block or divert sewer flow from entering the structure. Any infiltration leaks shall be stopped by using such methods as approved by the County.

B. The liner material shall be sprayed onto the invert, bench and wall areas. The sprayed-on material shall be applied such that the entire structure is lined with a structurally enhanced monolithic liner. The thickness of the wall liner material shall be such that it will withstand the hydraulic load generated by the surrounding groundwater table, using a factor of safety of two, and using the assumption that the groundwater table is at the level of the top of the structure. The invert and bench liner material shall be the same thickness as that required for the base of the wall.

C. No active sewer flow shall be allowed in the newly lined structure, nor shall any vacuum tests be performed, until the liner material has had adequate time to cure, as recommended by the liner material manufacturer.

D. Install the coating systems per manufacturer's recommendation and completely protect the structure from corrosion. The liner or coating systems must extend and seal onto manhole ring, onto and around pipe openings and any other protrusions, and completely cover the bench and flow invert. Provide a five (5)-year unlimited warranty on all workmanship and products. The work includes the surface preparation and application of the coating or liner system, and shall protect the structure for at least five (5) years from all leaks and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

3.06 CONNECTION TO EXSTING MANHOLE (NOT USED)

END OF SECTION

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SECTION 02100 SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers clearing, grubbing and stripping of the project site.

B. The Contractor shall clear and grub all of the area within the limits of construction or as required, which includes, but is not limited to utility easements. The width of the area to be cleared shall be reviewed by the County prior to the beginning of any clearing.

C. The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force in Manatee County. The Contractor shall comply with all applicable sections of these ordinances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees shall be preserved as hereinafter specified unless otherwise designated by the County. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, so as to provide for the safety of employees and others. Soil erosion control devices such as silt fences shall be installed to satisfy all Federal, State and County requirements.

3.02 GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. The County shall have the option to receive all excess topsoil materials. The Contractor shall pay all equipment and labor cost to deliver excess top soil material to a remote site chosen by the County within a five mile radius of the construction site. Should County not choose to receive any or all excess topsoil materials, the Contractor shall dispose of said material at no additional cost to County.

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris off site. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.05 PRESERVATION OF TREES

Those trees which are not designated for removal by the County shall be carefully protected from damage. The Contractor shall erect such barricades, guards and enclosures as may be considered necessary by him for the protection of the trees during all construction operation.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property adjacent to proposed project site. Trees, shrubbery, gardens, lawns and other landscaping, which are not designated by the County to be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.

B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.

C. Improvements to the land such as fences, walls, outbuildings and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.

D. The Contractor shall clean up the construction site across developed private property directly after construction is completed upon approval of the County.

3.07 PRESERVATION OF PUBLIC PROPERTY

The appropriate paragraphs of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements and all other damaged areas. This includes, but is not limited to the trimming of trees damaged by contractor's equipment.

END OF SECTION

SECTION 02220 EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Structural excavation shall consist of the removal of material for the construction of foundations for structures and other excavation designated on the drawings or in these specifications.

B. Structural excavation and backfill shall consist of furnishing material, if necessary and placing and compacting backfill material around structures to the lines and grades designated on the drawings, as specified or directed by the County.

C. Structural excavation and backfill shall include the furnishing of all materials, equipment and other facilities which may be necessary to perform the excavations, place and compact the backfill, install sheeting and bracing, and carry out any necessary dewatering. It shall also include the wasting or disposal of surplus excavated material in a manner and in locations approved by the County.

D. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to, protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 QUALITY ASSURANCE

A. Testing Agency:

1. In place soil compaction tests shall be performed by a qualified testing laboratory.
2. Compaction tests shall be taken every 500 feet, except in the road crossings or road shoulders. Tests are to be taken according to current FDOT Standards.

B. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM D1557, Moisture-Density Relations of Soils Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.

1.03 JOB CONDITIONS

A. The Contractor shall provide, operate and maintain all necessary pumps, discharge lines, well points, etc., in sufficient number and capacity to keep all excavation, bases, pits, etc., free from seepage, standing or running water at all times throughout the period of construction.

B. The Contractor shall assume all responsibility for the security of the excavation required, employing bracing, lining or other accepted means necessary to accomplish same.

C. Excavated areas shall be cleared of all debris, water, slush, muck, clay and soft or loose earth and shall be conditioned to the entire satisfaction of the County.

D. All excavated material unsuitable for use or which will not be used shall be disposed of in a manner consistent with State and County regulation.

E. All unsuitable organic materials, roots, logs, etc., found during excavation shall be removed by the Contractor and the trench shall be refilled with suitable material.

PART 2 PRODUCTS

2.01 MATERIAL FOR CONTROLLED FILL

A. Composition: Only approved material free from organic matter and lumps of clay, shall be used for backfill. Excavated earth free from debris or organic material may be used for backfilling foundations or fill.

B. Crushed stone and shell shall meet or exceed current FDOT Standards.

2.02 UNSUITABLE MATERIAL

Unsuitable material shall be defined as highly organic soil per ASTM D2487 Group PT. This includes, but is not limited to, such items as topsoil, roots, vegetable matter, trash, debris, and clays that cannot be dried sufficiently to obtain specified compaction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall verify that work preceding the affected work of this Section has been satisfactorily completed.

B. Conditions adversely affecting the work of this Section shall be corrected to the satisfaction of the County.

3.02 REMOVAL OF UNSUITABLE MATERIALS

A. The Contractor shall remove unsuitable material from within the limits of the Work.

B. Materials meeting requirements for controlled fill shall be stockpiled as necessary and in such a manner satisfactory to the County.

C. All material excavated shall be placed so as to minimize interference with public travel and to permit proper access for inspection of the work.

3.03 EXCAVATION

A. When concrete or shell subbase footing is to rest on an excavated surface, care shall be taken not to disturb the natural soil. Final removal and replacement of the foundation material and subbase compaction to grade shall not be made until just before the concrete or masonry is placed.

B. When any structural excavation is completed, the Contractor shall notify the County who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the County.

C. The elevations of the footing bottom and the base slab as shown on the Drawings, shall be considered as approximate and the County may order in writing, such changes in dimensions or elevations of the footings and slab base as necessary to secure satisfactory foundations.

D. All excavation shall be made within an area bounded by lines five feet outside and parallel to the exterior walls of the structure to allow for correct forming, shoring and inspection of foundation work. Pouring of concrete against earth side walls shall not be permitted.

E. If the ground is excavated below the grade called for by the Drawings or becomes unstable due to the Contractor's carelessness or operations, the ground shall be excavated to undisturbed native soil before continuing concreting operations.

F. If in the opinion of the County, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the County and if so directed, replaced by crushed stone or washed shell.

3.04 STRUCTURAL BACKFILL

A. Structural backfill shall not be placed until the footings or other portions of the structure or facility have been inspected by the County and approved for backfilling.

B. A minimum of 1-1/2" layer of lean concrete shall be placed as a working mat for the concrete base slabs and footings if required by the County.

C. Fill shall be placed in uniform layers not more than 12" thick and compacted to a minimum of 98 percent of the maximum density determined by ASTM D1557, Method A or C, or as directed by the County. The Contractor shall securely tamp the backfill with pneumatic rammer around all wall foundations. The method of compaction shall be satisfactory to the County.

D. Compaction of structural backfill by ponding and jetting may be permitted when, as determined by the County: the backfill material is of such character that it will be self-draining when compacted; foundation materials will not soften or be otherwise damaged by the applied water; no damage from hydrostatic pressure will result to the structure. Ponding and jetting within two feet below finished subgrade shall not be permitted in roadway areas. At the discretion of the County, ponding and jetting may be permitted with compaction layers not to exceed four feet.

E. Surplus material not used on-site shall be removed and disposed of off-site by the Contractor. In no case shall surplus material be deposited on adjacent lands. Fill used for grading shall be placed in layers not to exceed 12 inches in thickness and shall be compacted to a density equal or greater to that of the surrounding natural ground.

3.05 BACKFILLING AROUND STRUCTURES

A. Common fill and structural fill are specified for use as backfill against the exterior walls of the structures. Fill shall be placed in layers having a maximum thickness of eight (8) inches in loose state and shall be compacted sufficiently to prevent settlement. If compaction is by rolling or ramming, material shall be wetted down as required. Where material can be suitably compacted by jetting or puddling, the Contractor may use one of these methods. No boulders shall be allowed to roll down the slopes and hit the walls.

B. Backfilling shall be carried up evenly on all walls of an individual structure simultaneously. A variation of two (2) feet in elevation will be the maximum allowable. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength. Backfilling shall be subjected to approval by the County.

C. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least one foot above the bottom of the pipes:

1. Place structural fill in such areas for a distance of not less than three feet either side of the center line of the pipe in level layers not exceeding 6-inches in depth.
2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the County.
3. Structural fill shall be of the quality specified under Part 2 of this Section.

D. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan. No soft spots or uncompacted areas shall be allowed in the work.

E. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

3.06 FIELD QUALITY CONTROL

A. The density of soil in place shall be a minimum of 95 percent in accordance with ASTM test 1557-70T, Method A or C.

END OF SECTION

SECTION 02221 TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all dewatering, excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: vaults; duct conduit; pipe; roadways and paving; backfilling; required fill or borrow operations; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and dewatering.

B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations:

1. In connection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the County. During the progress of the work, the County may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.

3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specification, all sheeting and bracing shall be removed after completion of the piping or structure, care being taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.

4. The Contractor shall construct, to the extent he deems it desirable for his method of operation, the cofferdams and sheeting outside the neat lines of the pipeline trench or foundation unless otherwise indicated on the Drawings or directed by the County. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the pipeline or structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the pipeline or the enclosed masonry. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

5. Drawings of the cofferdams and design computations shall be submitted to the County and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in the State of Florida and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline and substructures.

B. Dewatering, Drainage and Flotation

1. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in-the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in-the-dry and not until the water level is a minimum of 18” below proposed bottom of excavation.

2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavation and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations. At all times during the construction operations, the groundwater levels shall be maintained at an elevation 18 inches below the lowest level where structures are being installed.

3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.

5. The Contractor shall furnish all materials and equipment to perform all work required to install and maintain the proposed drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

6. Where required, the Contractor shall provide a minimum of two operating groundwater observation wells at each structure to determine the water level during

construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the County prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.

7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the County for approval. Such approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.

8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.

9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the County.

10. Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be described below and shall be from an FDOT certified pit. For each material, the Contractor shall notify the County of the source of the material and shall furnish the County, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B. Bedding - shall conform to FDOT Standard Specifications for Road and Bridge Construction, Section 901 Coarse Aggregate, and shall be either coarse aggregate of Size No. 57 or coarse sand of Size No. 9. Washed shell size No.57 may be used as an alternate bedding material.

C. Structural Fill

1. Structural fill in trenches shall be used below spread footing foundations, slab-on-grade floors and other structures as backfill within three feet of the below grade portions of structures.

2. Shall be either soil classification A-1, A-2 or A-3, per AASHTO M-145, and shall be free of organic matter, lumps of clay or marl, muck, compressible materials, and rock exceeding 2.5 inches in diameter. Broken concrete, masonry, rubble or other similar materials shall not be used as backfill. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180.

D. Selected Common Fill - shall have the same material classification and requirements as Structural Fill, as described above.

E. Common Fill

1. Shall be either soil classification A-1, A-2, A-3, A-4, A-5 or A-6, per AASHTO M-145, and shall be free of organic matter, lumps of clay or marl, muck, compressible materials and rock exceeding 2.5 inches in diameter. Broken concrete, masonry, rubble or other similar materials shall not be used as backfill.

2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the County, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

E. Unsuitable Material - soil classification A-7 and A-8, per AASHTO M-145, shall not be used as backfill material.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavate trenches and pits for structures to the elevations indicated on the construction drawings. Take special care to avoid over-excavating or disturbing the bottom of the trench or pit, so that the soil at the bottom of the hole remains in a naturally compacted condition. Excavate to widths sufficient to provide adequate working room to install the required structures. Do not excavate the final layer of soil to the designed grade until just before placing the bedding, foundation, pipe, structure, or masonry work required. Remove boulders, rocks, logs or any unforeseen obstacles encountered.

B. In case the foundation soil found at the bottom of the trench or pit is soft, plastic or mucky, or does not conform to the soils classification specified as suitable foundation material, over-excavation to a greater depth will be required. Soils not meeting the classification required for foundation material shall be removed to a depth at least four inches below the bottom of the pipe, bedding or structure bottom elevation. Rock, boulders or other hard or lumpy material shall be removed to a depth 12 inches below the bottom of the pipe, bedding or structure bottom elevation. Remove muck, clay or other soft material to a depth as needed to establish a firm foundation.

C. Where possible, the sides of trenches should be vertical up to at least the spring line of the installed pipe.

D. Trench excavation shall be performed in accordance with Florida Statute Title XXXIII, Chapter 553, Part III, Trench Safety Act.

3.02 BACKFILLING

A. Backfill materials shall be placed on solid, firm, naturally compacted or compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, dry or dewatered in place soil foundations.

B. Where over-excavation is required due to nonconforming soil classification or rocky, unstable, or otherwise undesirable soil conditions, place Structural Fill or Selected Common Fill in the over-excavated zone up to the base of the bedding material layer. Compact the over-excavated zone to 98 percent of the maximum dry density of the material as determined by AASHTO T-180.

C. When backfilling in an over-excavated zone where moist or watery conditions exist, backfill shall be coarse No. 9 sand or a mixture of No. 57 coarse aggregate with either No. 9 coarse sand, A-1, or A-3 material.

D. After compaction, backfill material in the over-excavation zone shall form a solid and firm foundation on which to build up successive layers of backfill and structures.

E. Bedding materials shall be placed on solid, firm soil foundations and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180.

F. Concrete and masonry structures shall be backfilled using Structural Fill. Backfilling and compaction shall be underneath the structure and carried up evenly on all walls of an individual structure simultaneously. The maximum allowable difference in backfill elevations shall be two feet. No backfilling shall be allowed against concrete or masonry walls until the walls and their supporting slabs have been in place at least seven days or until the specified 28-day strength has been attained. Compaction of Structural Fill underneath the base and along the walls shall be 98 percent of the maximum dry density of the material as determined by AASHTO T-180. The Structural Fill shall be either dried or shall have water added so that the moisture content of the material is within a range that will allow the required density to be achieved.

G. Trenching backfill for pipe installation shall be Selected Common Fill for the pipe bedding zone. The pipe bedding envelope shall begin at the level four inches, six inches, or nine inches, depending on pipe diameter, below the bottom of the pipe, and shall extend vertically up to a level 12 inches above the top of the pipe. Where the in-place soil material within the four inch, six inch, or nine inch pipe bedding zone beneath the bottom of the pipe meets the soil classification for Selected Common Fill, undercutting of the trench below the bottom of the pipe will not be required. In this case, loosen the soil in the bottom of the trench immediately below the middle third of the pipe diameter, and place the pipe upon it. Where the in-place soil material within the pipe bedding zone does not meet the soil classification for Selected Common Fill, undercutting shall be required, and the bedding zone shall be backfilled with Selected Common Fill. In this case, place the pipe bedding material and leave it in a moderately firm uncompacted condition under the middle third of the pipe diameter, and compact the outer portions of the trench bottom to 98 percent of the maximum dry density. Soils that were over-excavated due to rocky, soft or otherwise unsuitable soil foundation conditions shall also be replaced with Selected Common Fill. Compaction of Selected Common Fill shall be 98 percent of the maximum dry density as determined by AASHTO T-180. Such backfill material shall have an optimized moisture content that will allow the required density to be achieved.

H. Pipe sections for gravity flow systems shall be laid with spigots downstream and bells upstream. Excavate for pipe bells before laying pipe. Lay pipe true to the lines and grades indicated on the construction plans. Place backfill material on both sides of the pipe and

compact to 98 percent of the maximum dry density of the material as determined by AASHTO T-180. Take special care to effectively fill and compact the material in the haunch areas under the sides of the pipe.

I. For pipes that are not installed under roadways or driveways, trenching backfill for pipe installation shall be Common Fill above the pipe envelope zone, and shall be compacted to 95 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density. For pipes that are installed under roadways or driveways, trenching backfill for pipe installation shall be Selected Common Fill above the pipe envelope zone, and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density. Selected Common Backfill shall be placed in layers not to exceed 6 inches. Common Backfill shall be placed in layers not to exceed 12 inches.

J. Backfill compaction tests shall be performed every 500 feet in pipe line trenches and for every utility structure. Test reports shall be presented to the County Inspector.

3.03 GRADING AND CLEAN UP

A. Surplus and unsuitable soil materials not used on-site shall be removed and disposed of off-site in a manner that is consistent with state and local regulations. In no case shall surplus or unsuitable material be deposited on-site or on adjacent lands.

B. The surface of backfilled areas shall be graded smooth and true to the lines and grades indicated on the construction plans. No soft spots or uncompacted areas shall be allowed in the work.

C. Upon completion of the work, leave the work areas and all adjacent areas in a neat and presentable condition, clear of all temporary structures, rubbish and surplus materials. Pile any salvageable materials that have been removed in neat piles for pickup by County crews, unless otherwise directed.

END OF SECTION

SECTION 02223 EXCAVATION BELOW GRADE AND CRUSHED STONE OR SHELL REFILL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. If in the opinion of the County, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the County and replaced by crushed stone or washed shell.

PART 2 PRODUCTS (NOT USED)

PART 3 MATERIALS

3.01 EXCAVATION AND DRAINAGE

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench stabilization shall be complete and effective.

B. Should the Contractor excavate below the grade shown on the Contract drawings because of negligence or for his own convenience; due to failure in properly dewatering the trench; disturbs the subgrade before dewatering is sufficiently complete; he shall be directed by the County to excavate below grade. The work of excavating below grade and furnishing and placing the approved refill material shall be performed at the Contractor's expense.

3.02 REFILL

A. Soils not meeting the classification required for foundation material shall be removed to a depth at least four inches below the bottom of the pipe, bedding or structure bottom elevation. Rock, boulders or other hard or lumpy material shall be removed to a depth 12 inches below the bottom of the pipe, bedding or structure bottom elevation. Remove muck, clay or other soft material to a depth as needed to establish a firm foundation.

END OF SECTION

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SECTION 02260 FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. The Contractor shall finish grade sub-soil.

B. The Contractor shall cut out areas to receive stabilizing base course materials for paving and sidewalks.

C. The Contractor shall place, finish grade and compact top soil.

1.02 PROTECTION

The Contractor shall prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement and utility lines. Damage shall be corrected at no cost to the County.

PART 2 PRODUCTS

A. Topsoil: Shall be friable loam free from subsoil, roots, grass, excessive amount of weeds or other organics, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter. The Contractor may use topsoil stockpiles on site if they conform to these requirements.

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

A. The Contractor shall rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Uneven areas and low spots shall be eliminated. Debris, roots, branches or other organics, stones, and sub-soil shall be removed by the Contractor and disposed of in a manner consistent with the latest Manatee County Standards as well as any affected regulatory agency. Should contaminated soil be found, the Contractor shall notify the County.

B. The Contractor shall cut out areas to sub-grade elevation to stabilize base material for paving and sidewalks and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density.

C. The Contractor shall bring sub-soil to required profiles and contour graces gradually; and blend slopes into level areas.

D. The Contractor shall slope the structure grade a minimum of two (2) inches in ten (10) feet unless indicated otherwise on the Drawings.

E. The Contractor shall cultivate sub-grade to a depth of 3 inches where the topsoil is to be placed. He shall repeat cultivation in areas where equipment use has compacted sub-soil.

F. The Contractor shall not make grade changes which causes water to flow onto adjacent lands.

3.02 PLACING TOPSOIL

A. The Contractor shall place topsoil in areas where seeding, sodding and planting is to be performed. He shall place from the following minimum depths, up to finished grade elevations:

1. 6 inches for seeded areas
2. 4-1/2 inches for sodded areas
3. 24 inches for shrub beds
4. 18 inches for flower beds

B. The Contractor shall use topsoil in a dry state as determined by the County. He shall place the material during dry weather.

C. The Contractor shall use fine grade topsoil eliminating rough and low areas to ensure positive drainage. He shall maintain levels, profiles and contours of the sub-grades.

D. The Contractor shall remove stone, roots, grass, weeds, debris, and other organics or foreign material while spreading the material.

E. The Contractor shall manually spread topsoil around trees, plants and structures to prevent damage which may be caused by grading equipment.

F. The Contractor shall lightly compact and place the topsoil.

3.03 SURPLUS MATERIAL

A. The Contractor shall remove surplus sub-soil and topsoil from site at his expense.

B. The Contractor shall leave stockpile areas and entire job site clean and raked, ready for landscaping operations.

END OF SECTION

SECTION 02276 TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of the design, provision, maintenance and removal of temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to: grassing, mulching, netting, watering, and the reseeding of on-site surfaces and spoil and borrow area surfaces, interceptor ditches at ends of berms and other such work at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the County.

C. Temporary sedimentation controls include, but are not limited to: silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which shall ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the County.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 REFERENCE DOCUMENTS

A. Florida Building Code.

B. FDEP/COE Dredge and Fill Regulations and/or Permit as applicable.

C. SWFWMD Permit Regulations and/or Permit as applicable.

D. Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Netting - fabricated of material acceptable to the County.

B. Seed and sod.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seed free cereal hay type.

B. Netting - fabricated of material acceptable to the County.

C. Filter stone - crushed stone conforming to Florida Dept of Transportation specifications.

D. Concrete block - hollow, non-load-bearing type.

E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing shall be:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

A. The Contractor shall install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Deteriorated hay bales and dislodged filter stone shall be replaced by the Contractor at his expense.

3.03 PERFORMANCE

A. The Contractor, at his own expense, shall immediately take whatever steps are necessary to correct any deficiencies of the temporary erosion and sediment control measures employed if they fail to produce results or do not comply with the requirements of the State of Florida or any other federal, governmental or regulatory agency.

END OF SECTION

SECTION 02355 LUMBER LEFT IN PLACE

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish and install shoring and sheeting as necessary to provide adequate safety.

PART 2 PRODUCTS

2.01 MATERIALS

Wood for shoring and sheeting shall be green, rough cut hardwood planking.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall furnish, install and maintain sheeting and bracing required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below which is necessary for proper construction and to protect adjacent structures from undermining or other damage. If the County determines that insufficient or improper supports have been provided, he may order additional supports to be installed at the expense of the Contractor. Compliance with such orders shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting. Should voids form, they shall be immediately filled and rammed.

B. The Contractor shall embed and leave in place all sheeting, bracing and other related items as shown on the Contract Drawings. The County may direct that sheeting and bracing timber be cut off at a specified elevation. No additional payment or compensation shall be made for this work.

C. Sheeting and bracing not left in place shall be removed carefully in such manner as not to endanger other structures, utilities, property, or proposed construction.

D. The County may order sheeting and bracing to be left in place; however, this shall not relieve the Contractor from liability for damages to persons or property due to negligence or the failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

E. The Contractor shall receive no payment other than that included in the pipe bid item price for any timber used for sheeting bracing, or other related items.

END OF SECTION

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SECTION 02485 SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials and equipment necessary to satisfactorily return all construction areas to their original conditions or better.

B. Work shall include furnishing and placing seed or sod, fertilizing, planting, watering and maintenance until acceptance by County.

1.02 RELATED WORK NOT INCLUDED

Excavation, filling and grading required to establish elevation shown on the Drawings are included under other sections of these Specifications.

1.03 QUALITY ASSURANCE

A. It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering and seeding or sodding at no additional cost to the County until a satisfactory stand is obtained. For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be sodded or seeded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 square yard within a radius of 8 feet.

B. All previously grassed areas where pipelines are laid shall be sodded. All sodding and grassing shall be installed in accordance with these Specifications or as directed by the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer: The fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitive analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Seeding/Grassing: The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications, Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications, except that no additional payment will be made for mulching, fertilizing and/or watering.

C. Sodding: Sod shall be provided as required on the construction drawings or at locations as directed by the County in accordance with Florida Department of Transportation, Specifications Section 575 and 981. The Contractor shall furnish bahia grass sod or match

existing sod. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract price bid for sodding.

D. Topsoil: Topsoil stockpiled during excavation may be used as necessary. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the County. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants and grassing specified herein.

E. Water: It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements that may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.01 INSTALLATION

A. When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as necessary and as directed by the County.

B. Finish Grading: Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated. The County shall approve the finish grade of all areas to be seeded or sodded prior to seed or sod application.

C. Areas to be sodded shall be excavated or cut-down to accept the approximate 2” thick sod, so finish grade matches existing. Sod shall not be thrown over top of existing sod or debris.

D. Protection: Seeded and sodded areas shall be protected against traffic or other use by placing warning signs or erecting barricades as necessary. Any areas damaged prior to acceptance by the County shall be repaired by the Contractor as directed by the County.

3.02 CLEANUP

Soil or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones and debris remaining shall be removed from the construction areas.

3.03 LANDSCAPE MAINTENANCE

A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the County.

B. Maintain landscape work for a period of 90 days immediately following complete installation of work or until County accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be included at no additional cost to the County.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATORS

Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing and sodding, in accordance with these Specifications.

END OF SECTION

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SECTION 02615 DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install ductile iron pipe and restrained joint ductile iron pipe and cast iron or ductile iron restrained joint fittings, complete, as shown on the Drawings and specified in these Standards.

B. Fittings are noted on the drawings for the Contractor's convenience and do not relieve him from laying and jointing different or additional items where required.

C. The Contractor shall furnish all labor, materials, equipment and incidentals required to install push-on joint or restrained joint ductile iron pipe, complete as shown on the Drawings and Specifications.

D. Newly installed pipe shall be kept clean and free of all foreign matter. All DI pipe installed underground shall be poly wrapped unless noted otherwise on the plans.

1.02 SUBMITTALS

A. The Contractor shall submit to the County, within ten days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers and the appropriate shop drawings for all ductile iron pipe and fittings.

B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to AWWA C150 and AWWA C151. Pipe shall be Pressure Class 350. All ductile iron pipe used in above ground applications shall be Special Thickness Class 53. All pipe materials used in potable water systems shall comply with NSF Standard 61.

B. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 ft. and shall be either the rubber-ring compression-type push-on joint or standard mechanical joint pipe as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or an approved equal.

C. All mechanical joint fittings shall be pressure rated for 350 psi for sizes 4-24 inches and 250 psi for sizes 30 inches and larger. All flanged fittings shall be pressure rated for 250 psi for all sizes. All fittings shall meet the requirements of AWWA C110 or AWWA C153.

D. Rubber gaskets shall conform to AWWA C111 for mechanical and push-on type joints and shall be Ethylene Propylene Diene Monomer (EPDM) rubber for potable water and reclaimed water pipelines. Standard gaskets shall be such as Fastite as manufactured by American Cast Iron Pipe Company, or an approved equal. Acrylonitrile butadiene (NBR) gaskets shall be used for potable water mains that are located in soil that is contaminated with low molecular-weight petroleum products or non-chlorinated organic solvents or non-

aromatic organic solvents. Fluorocarbon (FKM) gaskets shall be used for potable water mains that are located in soil that is contaminated with aromatic hydrocarbons or chlorinated hydrocarbons. Fluorocarbon (FKM) gaskets shall be used where both classes of contaminates are found.

E. Water Main and Reclaimed Water Main Coatings: All ductile iron pipe used in water and reclaimed water systems shall have a standard thickness cement lining on the inside in accordance with AWWA C104 and a standard 1-mil asphaltic exterior coating per AWWA C151. All ductile iron or gray iron fittings used in water and reclaimed water systems shall have standard thickness cement linings on the inside per AWWA C104 and an asphaltic exterior coating or they shall have factory-applied fusion bonded epoxy coatings both inside and outside in accordance with AWWA C550.

F. Wastewater Main Coatings: All ductile iron pipe and fittings used in wastewater sewer systems shall have a factory applied dry film thickness 40-mil Protecto 401 or 40-mil Novocoat SP2000W amine cured novalac ceramic epoxy lining on the inside. The interior lining application is to be based on the manufacturer's recommendation for long-term exposure to raw sewage. To ensure a holiday-free lining, documentation must be provided, prior to shipment, showing each section of lined pipe has passed holiday testing at the time of production per ASTM G62. The lining shall have a minimum one year warranty covering failure of the lining and bond failure between liner and pipe.

Exterior coatings for ductile iron pipe and fittings used in wastewater systems shall be either an asphaltic coating per AWWA C151 or a factory-applied epoxy coating per AWWA C550.

G. All ductile iron pipe associated with the force main or flow meter shall be mechanically restrained. Thrust restraint devices shall be restraining glands as manufactured by Star Pipe Products, Stargrip 3000 and 3100, Allgrip 3600, or as manufactured by EBAA Iron Sales, Megaflange, 2000 PV, or other approved equal restraining gland products. Restrained joints, where used, shall be installed at bend and fitting locations and at pipe joint locations both upstream and downstream from the bends or fittings at distances as required by these Standards. Restrained joint pipe fittings shall be designed and rated for the following pressures:

350 psi for pipe sizes up to and including 24" diameter
250 psi for pipe sizes 30" diameter and above

2.02 DETECTION

A. Pipe shall have a 3-inch wide warning tape of the proper color placed directly above the pipe 12 inches below finished grade or a 6-inch warning tape between 12 inches and 24 inches below finished grade.

B. Pipe shall have a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color installed along the pipe alignment as detailed in these standards. Tracer wire shall be manufactured by Copperhead Industries or Manatee County approved equal.

2.03 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size and class, lining type, and shall be clearly identified as ductile iron pipe. All gaskets shall be marked with the name of the manufacturer, size and proper insertion direction.

B. All ductile iron pipe 12 inches and smaller shall be entirely polyethylene-wrapped green for sewer mains, per AWWA C105.

C. All ductile iron pipe greater than 12 inches shall be spiral wrapped with color coded polyethylene at a six-inch minimum spacing, If soil testing, in accordance with AWWA C105, indicates that the soil at the site is corrosive, the ductile iron pipe shall be entirely polyethylene-wrapped with color coded polyethylene.

D. Poly-wrap shall be by V-BioTM Enhanced Polyethylene Encasement (or equivalent).

E. All above ground potable water mains and appurtenances shall be painted safety blue.

END OF SECTION

SECTION 02617 INSTALLATION AND TESTING OF PRESSURE PIPE

PART 1 GENERAL

Reference Section 1.8, Installation of Pipelines in the Manatee County Public Works Utility Standards Part 1-Utility Standards Manual.

1.01 GENERAL

A. Furnish and install pipe, fittings, valves, fire hydrants, services, and all other appurtenances and incidentals complete and in-place as required by the construction drawings.

B Trees shall not be planted or located within 10 feet of any potable water main, reclaimed water main, sanitary force main or gravity sanitary sewer main that is owned and maintained by County. With prior approval, an approved root barrier may be used with 5 feet of clearance.

C. Installation tolerances of Pipe Lines:

1. Direct Bury:
    a. Vertical Alignment = ±0.5 feet
    b. Horizontal Alignment = ±1.0 feet

1.02 HANDLING AND STORAGE

A. Prior to installation, all pipe and fittings shall be inspected. Cracked, broken, or otherwise defective materials not in compliance with these standards shall not be used and shall be removed from the project site.

B. The pipeline installer shall take care in the handling, storage and installation of the pipe and fittings to prevent injury to the materials or coatings. Use proper implements, tools and facilities for the safe and proper protection of the work. Lower the pipe and fittings from the truck to the ground and from the ground into the trench in a manner to avoid any physical damages. Under no circumstances shall the pipe or fittings be dropped onto the ground or into the trenches.

C. The pipeline installer shall not distribute material on the job site faster than it can be used to good advantage. Unless otherwise approved by the County, installer shall not distribute more than one week's supply of material in advance of laying. Any materials not to be installed within two weeks of delivery shall be protected from the sunlight, atmosphere and weather by suitable enclosures or protective wrapping until ready for installation. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's written instructions.

1.03 SURVEY MARKINGS

A. As a marker for the Surveyor, a PVC pipe marker or 2" x 4" marker shall be inserted by the Contractor on the top of pipe for potable water mains, reclaimed water mains and sanitary force mains at intervals no greater than 200 feet apart and at locations where there is a substantial grade change. The pipe markers shall indicate the pipe diameter and shall be

labeled PWM in “safety” blue, RWM in purple, and FM in green, for potable water mains, reclaimed water mains and sanitary force mains, respectively. The Contractor is responsible for making the aforementioned markers available to the Surveyor. The Contractor shall field locate the mains and fittings when markers are not made available to the Surveyor.

B. As a marker for the Surveyor, a PVC pipe marker or 2” x 4” marker shall be inserted by the Contractor on the top of all pipe fittings (other than sanitary sewer service wyes, potable water saddles and reclaimed water saddles). The markers for fittings shall indicate the type of fitting and shall be labeled PWF in “safety” blue, RWF in purple, and FMF in green, for potable water fittings, reclaimed water fittings, and sanitary force main fittings, respectively. The Contractor is responsible for making the aforementioned markers available to the Surveyor. The Contractor shall field locate the mains and fittings when markers are not made available to the Surveyor.

1.04 PROCEDURE FOR TESTING FORCE MAINS

A. A 48-hour notice is needed prior to testing. A letter stating the reasons testing should be scheduled ahead of other jobs must accompany all emergency testing requests.

B. County and Contractor must be present for all testing, except for testing tapping valves and sleeves.

C. HYDROSTATIC TESTING
1. Refer to Manatee County Public Works Utility Standards Part 1-Utility Standards Manual Section 1.8.7.

1.05 INSPECTION/TESTING PROCEDURE COVERING BORED PIPE LINES OR CASING AND CONDUITS INSTALLED ACROSS PREVIOUSLY TESTED AND/OR COUNTY ACCEPTED WATER AND SEWER PIPE WITHIN DEVELOPMENT PROJECTS UNDER ACTIVE CONSTRUCTION (NOT USED)

1.06 DETECTION

A. Direct buried pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe and 12" below finished grade or 6" detectable tape between 12" and 24" below finished grade.

B. Direct buried or horizontal directional drilled non-metalic pipe shall also have tracer wire installed along the pipe alignment. The tracer wire to be used shall be a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color manufactured by Copperhead Industries or Manatee County approved equal.

END OF SECTION

SECTION 02618 PIPELINE CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to clean all new lines 4" and larger, and existing pipelines as specified in this specification and as indicated on the Drawings.

B. This work shall include the furnishing and installation of all pig launching and retrieval devices and the appropriate pigs for the cleaning procedure, and all necessary excavations, shutdowns, fittings and valves required.

1.02 RELATED WORK

A. The contractor is responsible for all necessary supply water.

B. The contractor is responsible for all necessary bypass pumping.

C. The contractor is responsible for the proper disposal of any materials removed from the pipe lines as a result of the cleaning procedure.

1.03 SUBMITTALS

A. The Contractor shall submit prior to construction, a cleaning plan, Shop Drawings, and layout diagram for approval to the County.

B. The Contractor shall submit to the County a list of materials to be furnished, and the names of suppliers.

1.04 QUALIFICATIONS

A. The Contractor performing this work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner.

B. The Contractor shall also be capable of providing crews as needed to complete this work without undue delay.

C. The County reserves the right to approve or disapprove the Contractor, based on the submitted qualifications.

PART 2 PRODUCTS

2.01 GENERAL

A. The contractor shall be responsible for furnishing pigs in sufficient numbers and sizes, of appropriate densities, coatings and configurations to properly clean the piping systems.

B. All pigs used for the cleaning of sewer or reclaimed water lines shall not be used in the cleaning of potable water lines.

2.02 MATERIALS

A. The pig launching and retrieval equipment shall be of the latest design and construction and shall include the means to maintain constant monitoring of the in-line flows and pressures of the system being cleaned and the constant location of the cleaning pigs in the system. Launching and retrieval systems shall be fabricated, designed and manufactured according to ANSI standards and capable of withstanding working pressures of 150 psi. Launching and receiving devices shall be sized one diameter larger than the system to which it will be attached with a minimum length of 2.5 times the diameter.

B. The contractor shall have available for immediate use an electronic pig detector for use in the system being cleaned to provide a means of tracking the passage of the pig in the system to locate areas of potential or suspected blockage and other disparities in the system.

C. The pig shall be constructed of elastomer polyurethane with an open cell construction and a density equal to or suitable for use in the piping system being cleaned. Pig configuration shall consist of a parabolic nose with a concave base and coated with a resilient surface material that will maintain a peripheral seal and will effectively clean the piping system without over abrading the interior pipe wall. Pig characteristics shall include the ability to navigate through 90 degree bends, 180 degree turns, bi-directional fittings, full port valves, reduce its cross sectional area and return to its original design configuration and be propelled by hydraulic pressure.

PART 3 EXECUTION

3.01 PIPELINE CLEANING

A. The cleaning of the pipe line shall be done by the controlled and pressurized passage of a polyurethane pig of varying dimensions, coatings and densities as determined by the County through the piping system.

B. A series of pigs shall be entered into the system at a point as near to the beginning as is logistically and mechanically feasible.

C. A launching assembly shall be used as the entrance point for the pig. This assembly shall allow for the following:

1. The entering of pigs into the system by providing the means to induce flow from an external source, independent of the flows and pressures immediately available from the system, on the back of the pig to develop sufficient pressure to force the pig through the system.
2. A means to control and regulate the flow.
3. A means to monitor the flows and pressures.
4. A means to connect and disconnect from the system without any disruption to the operation of the system.

D. The pig shall be removed or discharged from the system at a point as near to the end as is logistically and mechanically feasible.

E. The contractor shall be responsible for the retrieval of the pig at the discharge point. This may include setting a trap that will not disrupt normal flow and operations but will capture the pig and any debris. A retrieval assembly may also be used but said assembly shall be

able to connect and disconnect from the system without any disruption to the operation of the system.

F. Alternative launching and retrieval methods shall be done with the prior approval of the County.

G. Any pig that cannot progress through the piping system shall be located by the contractor and removed by excavation of the pipe in order to remove the blockage. All pipe repairs shall be the responsibility of the contractor and shall be performed with as little disruption to the system as possible.

H. Any increase in pressure that cannot be accounted for, i.e. fittings or valves or additional cleaning runs, shall be investigated, per the Engineers' approval, by locating the pig at the beginning of the increased pressure and excavating to determine the cause of the pressure increase. All pipe repairs shall be the responsibility of the contractor and shall be performed with as little disruption to the system as possible.

I. Final flushing of the cleansed lines shall be performed after the last successful run of the pig as determined by the County. The contractor shall be responsible for all applicable flushing and disinfection requirements for potable water lines.

3.02 ACCEPTANCE

A. The contractor shall maintain and provide a report at the end of the cleaning procedure containing the following:

1. The pressures in the pipe during the pigging procedure.
2. Any inline problems encountered during the procedure including all excavations with detailed locations, reason for the excavation and any corrective measures taken to the pipeline.
3. A record of the pigs used, their sizes, styles and other pertinent information regarding what materials were used during the cleaning.
4. An analysis of the condition of the pipeline before and after the cleaning procedure.

END OF SECTION

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SECTION 02640 VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All of the types of valves and appurtenances shall be products of well-established reputable firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these standards as applicable. Valves used in waterworks applications shall comply with Section 8 of NSF Standard 61 for mechanical devices.

C. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaimed water, wastewater, etc., depending on the applications.

D. All valves and appurtenances shall be of the size shown on the drawings and, to the extent possible, all equipment of the same type on the project shall be from a single manufacturer.

E. All valves and appurtenances shall have the name of the manufacturer, year of the valve and the working pressure for which they are designed cast in raised letters upon some visible part of the body.

F. Special tools, if required for the normal operation or maintenance, shall be supplied with the equipment.

G. All hand actuated buried valves shall have three-piece adjustable valve boxes and 2-inch square AWWA operating nuts. Provide stainless steel extension stems and alignment rings where needed to bring the operating nut to within 4 feet below the box lid.

H. Isolation valves for sewer force main pipelines shall be gate valves, unless otherwise noted on the plans. Tapping valves shall be used for tapping force mains. Plug valves shall be full port, have a 100% circular cross section, and must have prior written authorization from the County for use.

I. Valves shall open when turning the operating nut or wheel counterclockwise and shall close when turning clockwise.

J. All bonnet bolts, gland bolts, flange connection bolts, nuts, washers, and other trim hardware exposed to the outside environment shall be stainless steel. Thrust collar tie-rod bolts shall be stainless steel. All MJ-type underground bolts, nuts, and washers shall be COR-TEN or stainless steel.

K. All valves shall have a factory applied, holiday free, fusion bonded epoxy coating on the interior and exterior unless otherwise noted in the plans or the following specification. All other painted items exposed to sunlight, including field painted box lids, etc., shall be painted the appropriate color with an epoxy type paint.

L. No valves with a break-way stem shall be allowed.

M. The equipment shall include, but not be limited to, the following:

1. Gate valves (Sec. 2.01)
2. Plug Valves (Sec. 2.05)
3. Valve Actuators (Sec. 2.06)
4. Air Release Valves (Sec. 2.07)
5. Valves Boxes (Sec. 2.08)
6. Flange Adapters and Plain End Couplings (Sec. 2.10)
7. Restrained Joints (Sec. 2.14)
8. Tapping Sleeves and Tapping Valves (Sec. 2.15)
9. Tracer Wire Boxes (Sec. 2.16)
10. Pressure Gauges (Sec. 2.17)
11. Equipment Connection Fittings (Sec. 2.18)
12. Sleeve-Type Couplings (2.19)

1.02 SUBMITTALS

A. Submit to the County within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Complete shop drawings of all valves and appurtenances shall be submitted to the County for approval in accordance with the Specifications.

1.03 TOOLS

Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 GATE VALVES

A. Gate valves installed underground shall be provided with a box cast in a concrete pad and a box cover. Stainless steel or equivalent valve extension stems shall be provided to place the valve operating nut no more than 4 feet deep. One valve wrench, 6 feet in length, shall be provided for every 15 valves installed.

B. Gate valves 2 inches to 14 inches in diameter shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 or AWWA C515 and shall be UL listed and FM approved where applicable. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

C. The valves shall have a non-rising stainless steel stem to eliminate lead content. All bolts, nuts and washers shall be stainless steel to eliminate exterior corrosion and maintain fastener strength. Manufacturer shall use Never-Seez or equivalent during assembly of bolt and nut sets to prevent galling of similar metals. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar. Valves that are located above grade and located in valve vaults shall be OS&Y with flanged joints.

D. The wedge shall be ductile iron fully encapsulated with an EPDM rubber. The Elastomer type shall be permanently indicated on the disc or body of the valve. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

E. The valve body, bonnet, and bonnet cover shall meet or exceed all the requirements of AWWA C515.

F. Valves meeting AWWA C515 requirements shall be rated for an operating pressure of 250 psi and shall be tested in accordance with AWWA C515.

G. The valves are to have 2-inch cast or ductile iron AWWA operating nuts and shall open left or counterclockwise.

H. The valves shall be covered by a Manufacturer's 10 year warranty on manufacturer's defects and reasonable labor costs for replacement. Warranty shall become effective from the date of purchase by the end user and delivered within 30 days from the receipt of the purchase order. For publicly owned and maintained utilities, the end user is Manatee County Government.

I. Gate valves shall be assembled and tested in a certified ISO 9001:2000 manufacturing facility within the United States and provide their certification of meeting internationally recognized quality control procedures.

2.02 COMBINATION PRESSURE REDUCING & PRESSURE SUSTAINING WITH CHECK VALVE OPTION (NOT USED)

2.03 BALL VALVES (NOT USED)

2.04 BUTTERFLY VALVES (NOT USED)

2.05 PLUG VALVES

A. Plug valves shall be eccentric, non-lubricating type with integral plug and shafts and shall be furnished with end connections and with actuating mechanisms as called for on the construction plans or as otherwise required. Valves shall seal bubble-tight or water drop-tight in both directions when tested according to the Leakage Test method of AWWA C504 with a hydrostatic pressure of 150 psi.

B. Plug valves shall also be subjected to the internal, full body Hydrostatic Test of AWWA C504 at a pressure two times the rated pressure or a minimum pressure of 300 psi, whichever is greater. During the test, there shall be no leakage through the metal, or through the end joints or shaft seal, nor shall any part of the valve be deformed. Plug valves shall be Kennedy or Dezurik.

C. Flanged valve ends shall be faced and drilled according to ANSI B 16.1, Class 125. Mechanical joint valve ends shall conform to AWWA C111. Threaded ends shall conform to the NPT requirements of ANSI B1.20.1.

D. The plug valve body, bonnet and gland shall be ductile iron per ASTM A 126, Class B. The integral plug and shafts shall be cast iron ASTM A 126, Class B, or 316 stainless steel. The entire plug, except for the shafts, shall be covered with nitrile (Buna N) rubber. The rubber

compound shall have been vulcanized to the metal plug and shall have a peel strength of not less than 75 pounds per inch when tested according to ASTM D 429, method B. The valve seat shall be at least 90 percent pure nickel, welded-in overlay into the cast iron body. The top and bottom bearings shall be 316 stainless steel.

E. Plug valves shall have a full port area of 100 percent of the nominal pipe size area.

F. Valves shall have worm gear type actuators with 2-inch square operating nuts.

G. Plug valves shall be installed side-ways with plug shaft horizontal so that the plug rotates upward when it opens, with the flow entering the seat end of the valve.

H. Plug valves shall be coated inside with Protecto 401 or amine-cured novolac ceramic epoxy or another two-part epoxy suitable for sanitary sewer service which has been approved by Manatee County.

2.06 VALVE ACTUATORS

A. Manual Actuators.

Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves. Manual actuators shall be of the traveling nut, self-locking type or of the worm gear type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a 2-inch square AWWA operating nut located at ground level and cast iron extension type valve box.

2.07 AIR RELEASE VALVES

A. Air release valves shall be automatic float operated, GA Industries fig-929 for sewer applications, or an approved equal, with inlet size and working pressure ratings as required and NPT connections.

B. Valve bodies shall be ductile iron per ASTM A 126, Class B. The orifice, float and linkage shall be stainless steel. The seat shall be (Buna N) nitrile elastomer.

2.08 VALVE BOXES

A. Buried valves shall have adjustable cast iron or HDPE valve boxes. Lids shall be cast iron drop type, and shall have "SEWER", cast into the top. Lids will be painted "safety" green for sanitary sewer.

B. Cast iron boxes shall be two-piece, or three-piece, as required, screw type, Tyler Pipe, 6850 Series, Box 461-S through 668-S, with extensions, as required to make the desired box length, or an approved equal. Bottom barrel shall be 5-1/4 inches inside diameter, with a flanged bottom with sufficient bearing area to prevent settling.

C. HDPE boxes shall be two-piece, adjustable, 1/4-inch thick minimum heavy wall, high density polyethylene, with cast iron top and stainless steel adjustable stem, Trench Adapter, as manufactured by American Flow Control, or an approved equal. Bottom barrel shall have flanged bottom to prevent settling. All bolts, screws and pins shall be stainless steel.

D. All valves shall either have operating nuts within 4 feet below the top of the lid or shall have extension stems with centering guides to provide an extended operating nut within 4 feet below the lid. Extension stems shall be fixed to the valve operating nut with a stainless steel fastener.

E. All sewer grade-adjustment risers shall be cast iron material just like the valve box. No plastic or steel risers shall be allowed.

F. A centering device BoxLok or equal shall be installed in the valve box.

G. Stand pipe shall match color code of the system being installed, (green for sanitary sewer).

2.09 CORPORATION STOPS AND SADDLES (NOT USED)

2.10 FLANGED ADAPTERS AND PLAIN END COUPLINGS

Plain end couplings and adapters shall be fusion-bonded epoxy coated carbon steel with Ethylene Propylene Diene Monomer (EPDM) rubber gaskets and stainless steel nuts, bolts and spacers. Couplings shall be Dresser Style 38, or another approved equal. Flange adapters shall have a plain end compression seal similar to the style 38, with an ANSI 125 Class flange on the opposite end, and shall be Dresser Style 128W or an approved equal. Stainless steel backup rings shall be used for force mains that are located in corrosive environments including wetwells and valve vaults.

2.11 HOSE BIBS (NOT USED)

2.12 SWING CHECK VALVES (NOT USED)

2.13 HYDRANTS (NOT USED)

2.14 RESTRAINED JOINTS

A. Pipe joints shall be restrained by mechanical methods, including tie rods, Stargrip and Allgrip, as manufactured by Star Pipe Products or Megaflange and 2000 PV, as manufactured by EBAA Iron Sales. Flanged joints may be used above ground.

B. All T-bolts, bolts, nuts, washers, and all thread rods shall meet ASTM A-588 requirements (Cor-ten or equivalent) “weathering steel” or be 316 stainless steel. The use of rebar with welded thread is prohibited.

A certification from the supplier shall be provided to the County during the shop drawing review process ensuring all T-bolts, bolts, nuts, washers, and all thread rods meet the A-588 requirements and shall state the project name and contractor in the certification letter. If stainless steel is to be used, no certification letter is required.

C. Restrained joints may also be Lok-Ring, as manufactured by American Cast Iron Pipe Company, or an approved equal.

D. Restrained joint designs, which require wedges and/or shims to be driven into the joints in order to disassemble the pipe shall not be allowed.

2.15 TAPPING SLEEVES AND VALVES

A. Tapping valves shall meet the requirements of AWWA C509/C515 with ductile iron body and shall be rated for a pressure of 250 psi. The valves shall be flanged with alignment ring by mechanical joint with a nonrising stainless steel stem. All bolts, nuts and washers shall be stainless steel. Manufacturer shall use Never-Seez or equivalent during assembly of bolt and nut sets to prevent galling of similar metals. Stem seals shall be provided and shall be of the O-ring type, two above and one below the valve's thrust collar. Valve shall be designed for vertical burial and shall open counterclockwise. Operating nut shall be AWWA standard 2-inch square for valves 2 inches and up. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve to accommodate full size shell cutter. Gaskets shall cover the entire area of the flange surface and be 1/8-inch minimal thickness of red rubber. The wedge shall be ductile iron fully encapsulated with EPDM rubber. All bolts, nuts and washers between the sleeve and valve shall be stainless steel.

B. Tapping sleeves and saddles shall be stainless steel, seal to the pipe by the use of a gasket compounded for water or sewer, and shall be able to withstand a pressure test of 180 psi for water lines or 150 psi for sewer force mains for one hour with no leakage in accordance with AWWA C110. A stainless steel 3/4-inch NPT test plug shall be provided for pressure testing. All bolts joining the two halves shall be stainless steel and shall be included with the sleeve or saddle; Romac SST III or Romac SST-H.

2.16 TRACER WIRE TEST STATION BOXES

Tracer wire test station boxes shall be provided at plug valves as indicated in these Standards. Tracer wire test station boxes for yard service shall be 2 ½ inch diameter, 15 inch length, ABS plastic with a cast iron rim and lid, P200NFGT as manufactured by Bingham & Taylor, or equal approved by Manatee County. Where test boxes will be in streets or subject to vehicular traffic, use B&T Model P525RD, 5 ¼ -inch diameter or equal, centered in a separate concrete pad similar to a valve box pad.

2.17 Pressure Gauges

Unless otherwise specified, pressure gage scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale, shall be 4 1/2-inch, 270-degree movement, 1/2-percent accuracy, full-scale, and suitable for bottom stem mounting. Gages shall have a 316-SS bourdon tube. All gages shall have a 300 series stainless steel case, shatterproof glass, and a 1/2-inch NPT bottom connection.

Pressure gages for air, gas, and low-pressure services (0-10 feet) shall be premium grade, heavy-duty bourdon-tube units (bellow type for vacuum) with Delrin bushings and pinion, and stainless-steel sector.

Gages on liquid service shall be as noted above, except they shall be provided with an internal pulsation dampening system consisting of either a glycerin fill or a silicone fluid fill. Snubbers or

orifices shall not be utilized. Gages shall be Ashcroft Duragauge Fig. 1279, Ametek 1981L, or equal.

2.18 Equipment Connection Fittings

Equipment connection fittings shall provide both lateral and angular misalignment adjustment between equipment connection flanges and the connection to field piping systems by providing individually adjustable flexible joints at each connection. In addition, equipment connection fittings shall provide full pressure thrust restraint between the field piping connection and equipment connection flanges.

Equipment connection fittings shall consist of two flanged coupling adapters, a plain end section of pipe and thrust restraint rods and associated fittings designed to transmit thrust without transmitting shear to the thrust restraint rods and without compromising provisions for accommodating angular and parallel misalignment. Materials and features shall conform to the requirements established in this paragraph. Standard “dismantling joints” incorporate only one flanged coupling adapter and are not acceptable substitutes. Equipment connection fittings shall be Romac ECF Series, or Baker Coupling Company, or equal, modified as specified to provide the required features.

Equipment connection fittings shall each consist of a single sleeve of plain end piping conforming to the requirements of the specified piping system of sufficient length to span the gap between the connection at the equipment and the connection at the field piping with gasketed flange adapters at each end. Thrust restraint shall be provided by means of all threaded rod spanning between flanges and male rod nuts and female washers that are rounded to provide a ball-joint type self aligning feature. All threaded restraint rod shall project through flange and mating flange coupling adapter bolt holes or through holes in restraint lug plates that extend above the flanges and are secured to the flanges with a minimum of two flange bolts. Where all threaded rods project through flange bolt holes, ball joint type nut and washer combinations and lock washers shall be provided at each face, each end. Where restraint lug plates are employed, ball joint type nuts and washers shall be provided only on the outside faces of the plates and the nuts shall have a self-locking feature that prevents nut movement due to vibration or other operational or environmental causes. Double nutting with non-locking nuts shall not be an acceptable method of providing the self-locking feature. Thrust rod diameter and material shall be selected to provide sufficient freedom of movement through all bolt holes to allow unrestricted maximum adjustment of equipment connection fittings to accommodate piping misalignment without transmitting any shear to the thrust rods and also to permit full development of thrust restraint at all thrust rod tension take-ups. Design of equipment connection fittings shall conform to AWWA C219.

Thrust rods, restraint lug plates, nuts, washers and lock washers shall be Type 316 stainless steel, all selected to develop full rated piping system pressure thrust forces. Equipment connection fittings for pump applications shall have thrust rod number and diameter selected such that thrust rod stretch under piping system operating pressure does not exceed 2 mils. Calculations shall be submitted. Dry film molybdenum di-sulfide anti-galling compound shall be factory applied to ends of thrust rods, covering all threads subject to nut travel and tightening. Flange gaskets shall be full face type. Follower gaskets shall be compression wedge type.

Sleeves shall be carbon steel or as specified for the specific piping system. Pressure rating of flange adapters shall equal or exceed the pressure rating of mating flanges. All metal portions of equipment connection fittings, with the exception of 316 stainless steel components, shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61.

2.19 Sleeve Type Couplings

A. Unless otherwise specified, sleeve-type mechanical pipe couplings shall be Smith-Blair Type 411, Dresser Style 38, or equal, with the stop removed from the middle ring.

B. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.

C. Gaskets shall conform to gasket requirements listed in Specification 02615-2.01.D.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the County.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the County.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections.

E. Flanged joints and mechanical joints shall be made with high strength, low alloy Corten or 316 stainless steel bolts, nuts and washers.

F. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.

G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8". Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6" from the end.

H. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical

joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and the top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 HYDRANTS (NOT USED)

3.03 SHOP PAINTING

Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.04 FIELD PAINTING

All metal valves and appurtenances specified herein and exposed to view shall be painted safety blue.

3.05 INSPECTION AND TESTING

All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure and leak testing. Refer to Manatee County Public Works Utility Standards Part 1-Utility Standards Manual Section 1.8.7. Prior to testing, the pipe lines shall be supported in a manner approved by the County to prevent movement during tests.

All leaks shall be repaired and lines retested as approved by the County.

END OF SECTION

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SECTION 02720 SANITARY SEWER BYPASS PUMPING

PART 1 GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, materials, equipment and incidentals required to maintain existing and anticipated flows within the affected portion of the collection system throughout the construction period.

1.02 PUBLIC IMPACTS

The contractor shall not create a public nuisance due to excessive noise or dust, nor impact the public with flooding of adjacent lands, discharge of raw sewage, or release of other potential hazards, nor shall he encroach on or limit access to adjacent lands. No extra charge may be made for increased costs to the contractor due to any of the above.

1.03 SUBMITTALS

A. The Contractor shall, within 30 days of the date of the Notice to Proceed, submit to the Project Manager a detailed Pumping Plan for each site by-pass pumping will be needed. The Pumping Plan shall address all measures and systems to prevent a sanitary sewer overflow (SSO) as defined by the EPA. The Plan shall include as a minimum:

1. Working drawings and sketches showing work location, pump location, piping layout & routing. Show all proposed encroachment and access impacts on adjacent properties or facilities.
2. Pump, control, alarm and pipe specifications or catalog cuts. Detailed sketch of controls and alarm system.
3. Power requirements and details on methods to provide by-pass power or fueling.
4. Calculation and determination of response times to prevent an SSO after a high water alarm. If anticipated peak flows are 750 G.P.M. or greater, an operator is required on site at all times pump is in service (24 hours a day).
5. Procedures to be taken in case of power, pump, or piping failures; including contact names and numbers for emergency notifications.
6. Frequency and specific responsibility for monitoring pump operation, fuel levels, pump maintenance and entire length of piping.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Pumps:

1. By-pass pumping system shall consist of at least a primary pump and a backup pump. Each pump shall have a minimum pumping capacity of 100% of the anticipated peak flows. When bypassing a pump station, 100% of the lift station capacity (G.P.M. & T.D.H) shall be provided.
2. Pumps shall be low noise or sound attenuated. The noise level at any operating condition, in any direction, shall not exceed 70dBA at a distance of twenty three (23) feet (7 meters) from the pump and/or power source.

B. Controls:

The by-pass pump system shall be equipped with automatic controls and an alarm system. The automatic controls will automatically start the backup pump in the event of a high water condition or failure of the primary pump. The alarm system will immediately notify the Contractor of a pump failure or high water condition.

C. Pipe:

Pipe shall be of adequate size and capacity to match the pumps. Pipe type and materials will depend on the particulars of the site conditions, and shall be detailed in the Pumping Plan. Contractor will provide all connections.

PART 3 EXECUTION

3.01 SITE CONDITIONS

Site conditions will vary by site. Contractor is responsible to determine and address requirements such as traffic control, excavation, connections & fittings, impacts on access to adjacent properties, routing and support of by-pass piping, etc., in the Pumping Plan.

3.02 ON-SITE MONITORING

A. All by-pass operations where the anticipated flow rates are 750 G.P.M or greater shall require an employee on-site at all times (full-time on-site monitoring attended by personnel experienced with the pumps and controls, with demonstrated ability to monitor, turn on & off, and switch between pumps while the by-pass pump system is in service.

B. By-pass operations where the anticipated flow rates are less than 750 G.P.M may not require an employee on-site at all times while the by-pass pump system is in operation. The Contractor shall have personnel experienced with the pumps and controls on site within the calculated response time to prevent an SSO after a high water alarm.

C. During by-pass operations, the Contractor shall have posted on site with the permit, a copy of the approved Plan and the name and 24 hour contact number of the primary response person, the job site superintendent, and the construction company owner.

3.03 OPERATIONS

A. The Contractor is responsible for securing and providing power, fuel, site security, traffic control and all other supplies, materials and permits required for the by-pass pumping.

B. Contractor shall demonstrate automatic pump switching and alarm system to the satisfaction of: the County inspector, Project Manager, or Lift Stations Superintendent prior to beginning by-pass pumping. Satisfactory demonstration shall be documented by the inspector's, PM's or Lift Station Superintendent's dated signature on the posted copy of the approved Pumping Plan.

3.04 DAMAGE RESTORATION & REMEDIATION

A. The Contractor shall be responsible for any pre-pump notifications, all restoration of pre-pump conditions and any damage caused by by-pass operations.

B. Should there be an SSO caused by or as a direct result of the by-pass pumping, the contractor is responsible for all immediate & long term response, notifications, clean up, mitigation, etc. Copies of all written response plans, notifications, documentation, mitigation plans, etc., shall be submitted to the County Project Manager.

END OF SECTION

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SECTION 03300 CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install concrete, reinforcing, and related materials.
2. The Work includes:

   a. Providing concrete consisting of portland cement, fine and coarse aggregates, water, and approved admixtures; combined, mixed, transported, placed, finished, and cured.
   b. Fabricating and placing reinforcing, including ties and supports.
   c. Design, erection, and removal of formwork.
   d. Building into the concrete all sleeves, frames, anchorage devices, inserts, and other items required to be embedded in concrete.

B. Coordination:

1. Review installation procedures under other Sections and coordinate installation of items to be installed in the concrete Work.

C. Classifications of Concrete:

1. Class “A” concrete shall be steel-reinforced and includes all concrete unless otherwise shown or indicated.

D. Related Sections:

1. Section 05501, Anchor Bolts.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ACI 224R, Control of Cracking in Concrete Structures.
2. ACI 301, Specifications for Structural Concrete for Buildings.
3. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305R, Specification for Hot Weather Concreting.
5. ACI 306R, Cold Weather Concreting.
6. ACI 309R, Guide for Consolidation of Concrete.
7. ACI 318, Building Code Requirements for Structural Concrete and Commentary.
8. ACI 347, Guide to Formwork for Concrete.
9. ACI SP-66, ACI Detailing Manual.
10. ASTM A82/A82M, Specification for Steel Wire, Plain, for Concrete Reinforcement.
11. ASTM A185/A185M, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
12. ASTM A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

13. ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
14. ASTM C33/C33M, Specification for Concrete Aggregates.
15. ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
16. ASTM C42/C42M, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
17. ASTM C94/C94M, Specification for Ready-Mixed Concrete.
18. ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
19. ASTM C143/C143M, Test Method for Slump of Hydraulic-Cement Concrete.
20. ASTM C150/C150M, Specification for Portland Cement.
21. ASTM C172, Practice for Sampling Freshly Mixed Concrete.
22. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
23. ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
24. ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. ASTM C494/C494M, Specification for Chemical Admixtures for Concrete.
26. ASTM C579, Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
27. ASTM C1064/C1064M, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
28. ASTM D1752, Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
29. ASTM E96/E96M, Test Methods for Water Vapor Transmission of Materials
30. ASTM E154, Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
31. CRD-C 572, U. S. Army Corps of Engineers Specification for Polyvinylchloride Waterstops.
32. CRSI 1MSP, Manual of Standard Practice.

1.03 QUALITY ASSURANCE

A. Laboratory Trial Batch:

1. Employ independent testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
2. Each concrete mix design specified shall be verified by laboratory trial batch, unless indicated otherwise.
3. Perform the following testing on each trial batch:

    a. Aggregate gradation for fine and coarse aggregates.
    b. Slump.
    c. Air content.
    d. Compressive strength based on three cylinders each tested at seven days and at 28 days.

4. Submit for each trial batch the following information:
    a. Project identification name and number (if applicable).
    b. Date of test report.
    c. Complete identification of aggregate source of supply.

d. Tests of aggregates for compliance with the Contract Documents.
e. Scale weight of each aggregate.
f. Absorbed water in each aggregate.
g. Brand, type, and composition of cementitious materials.
h. Brand, type, and amount of each admixture.
i. Amounts of water used in trial mixes.
j. Proportions of each material per cubic yard.
k. Gross weight and yield per cubic yard of trial mixtures.
l. Measured slump.
m. Measured air content.
n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28-day test, and for each design mix.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Drawings:
   a. List of concrete materials and concrete mix designs proposed for use. Include results of tests performed to qualify the materials and to establish the mix designs. Do not start laboratory trial batch testing until this submittal is approved by ENGINEER.
   b. Laboratory Trial Batch Reports: Submit laboratory test reports for concrete cylinders, materials, and mix design tests.
   c. Concrete placement drawings showing the location and type of all joints.
   d. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI SP-66. For walls and masonry construction, provide elevations to a minimum scale of 1/4-inch to one foot. Show bar schedules, stirrup spacing, adhesive dowels, splice lengths, diagrams of bent bars, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing.
2. Product Data:
   a. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
3. Samples:
   b. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources, and descriptions.

B. Informational Submittals: Submit the following:
1. Delivery Tickets: Copies of all delivery tickets for each load of concrete delivered to or mixed at the Site. Each delivery tickets shall contain the information in accordance with ASTM C94/C94M along with project identification name and number (if any), date, mix type, mix time, quantity and amount of water introduced.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transportation, Delivery, and Handling:
1. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.
2. Materials used for concrete shall be clean and free from foreign matter during transportation and handling, and kept separate until measured and placed into concrete mixer.
3. Implement suitable measures during hauling, piling, and handling to ensure that

segregation of coarse and fine aggregate particles does not occur and grading is not affected.

4. Deliver grout materials from manufacturers in unopened containers that bear intact manufacturer labeling.
5. Comply with Section 01 65 00, Product Delivery Requirements.

B. Storage:

1. Store formwork materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective, waterproof covering. Provide for adequate air circulation or ventilation under cover.
2. Store concrete reinforcing materials to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground. Space framework or blocking supports to prevent excessive deformation of stored materials.
3. Store concrete joint materials on platforms or in enclosures or covered to prevent contact with ground and exposure to weather and direct sunlight.
4. For storage of concrete materials, provide bins or platforms with hard, clean surfaces.
5. Comply with Product Storage and Handling Requirements as required by product manufacturers and Owner.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type II.

B. Aggregates: ASTM C33/C33M.

1. Fine Aggregate: Clean, sharp, natural sand free of loam, clay, lumps, and other deleterious substances. Dune sand, bank run sand, and manufactured sand are unacceptable.
2. Coarse Aggregate:
   a. Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter.
   b. Coarse aggregate shall comply with the following:
      1) Crushed stone, processed from natural rock or stone.
      2) Washed gravel, either natural or crushed. Slag, pit gravel, and bank-run gravel are not allowed.
   c. Coarse Aggregate Size: ASTM C33/C33M, Nos. 57 or 67, unless otherwise approved by ENGINEER.

C. Water: Clean, potable.

D. Admixtures:

1. Air-Entraining Admixture: ASTM C260.
2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
3. Water Reducing and Set-Adjusting Admixtures: ASTM C494/C494M, Types D and E.
4. High Range Water-Reducing Admixture: ASTM C494/C494M, Type F/G.
5. Use only admixtures that have been tested and approved in the mix designs.
6. Do not use calcium chloride or admixtures containing chloride ions.

2.02 CONCRETE MIX

A. General:

1. Normal weight: 145 pounds per cubic foot.
2. Use air-entraining admixture in all concrete. Provide not less than four percent, nor more than eight percent, entrained air for concrete exposed to freezing and thawing, and provide from three to five percent entrained air for other concrete.

B. Proportioning and Design of Class "A" Concrete Mix:

1. Minimum compressive strength at 28 days: 4,500 psi.
2. Maximum water-cement ratio by weight: 0.42.
3. Minimum cement content: 564 pounds per cubic yard.

C. Slump Limits:

1. Proportion and design mixes to result in concrete slump at point of placement of not less than one inch and not more than four inches.
2. When using high-range water reducers, slump prior to addition of admixture shall not exceed three inches. Slump after adding admixture shall not exceed eight inches at point of placement.

D. Adjustment of Concrete Mixes:

1. Concrete mix design adjustments may be requested by CONTRACTOR when warranted by characteristics of materials, Site conditions, weather, test results, or other, similar circumstances.
2. Submit for ENGINEER's approval laboratory test data for adjusted concrete mix designs, including compressive strength test results.
3. Implement adjusted mix designs only after ENGINEER's approval.
4. Adjustments to concrete mix designs shall not result in additional costs to OWNER.

2.03 FORM MATERIALS

A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection. CONTRACTOR shall be responsible for designing the formwork system to resist all applied loads including pressures from fluid concrete and construction loads.

B. Smooth Form Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces in accordance with ACI 301.

C. Unexposed Concrete Surfaces: Material to suit project conditions.

D. Provide 3/4-inch chamfer at all external corners. Chamfer is not required at re-entrant corners unless otherwise shown or indicated.

E. Form Ties:

1. Provide factory-fabricated, removable, or snap-off metal form ties, that prevent form deflection and prevent spalling of concrete surfaces upon removal. Materials used for tying forms are subject to approval of ENGINEER.
2. Unless otherwise shown or indicated, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5 inches from outer surface of

concrete. Unless otherwise shown or indicated, provide form ties that, upon removal, will leave a uniform, circular hole not larger than one-inch diameter in the concrete surface.

3. Ties for exterior walls, below-grade walls, and walls subject to hydrostatic pressure shall be provided with waterstops.
4. Wire ties are unacceptable.

2.04 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.

B. Welded Wire Fabric: ASTM A185/A185M.

C. Steel Wire: ASTM A82/A82M.

D. Provide supports for reinforcing including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.

1. Use wire bar-type supports complying with CRSI MSP1 recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.
2. For slabs on grade, use precast concrete blocks, four inches square minimum with compressive strength equal to or greater than the surrounding concrete, or supports with sand plates or horizontal runners where base materials will not support chair legs.
3. For all concrete surfaces where legs of supports are in contact with forms, provide supports having either hot-dip galvanized, plastic-protected, or stainless steel legs in accordance with CRSI MSP1.
4. Provide precast concrete supports over waterproof membranes.

E. Adhesive Dowels:
1. Dowels:
   a. Dowel reinforcing bars shall comply with ASTM A615, Grade 60.
1. Adhesive:
   a. For requirements for adhesive, refer to Section 05501, Anchor Bolts.

2.05 RELATED MATERIALS

A. Vapor Retarder:

1. Products and Manufacturers: Provide one of the following:
   a. Stego Wrap 10-mil Vapor Retarder, by Stego Industries LLC.
   b. Griffolyn 10-mil, by Reef Industries.
   c. Moistop Ultra, by Fortifiber Industries.
   d. Or equal.
2. Vapor retarder membrane shall comply with the following.
   a. Water Vapor Transmission Rate, ASTM E96/E96M: 0.04 perms or lower.
   b. Water Vapor Retarder, ASTM E1745: Meets or exceeds Class C.
   c. Thickness of Retarder (plastic), ACI 302 1R: Not less than 10 mils.
   d. Provide accessories by same manufacturer as vapor retarder.

B. Membrane-Forming Curing Compound: ASTM C309, Type I.

C. Epoxy Bonding Agent:

1. Two-component epoxy resin bonding agent.
2. Products and Manufacturers: Provide one of the following:
    a. Sikadur 32, Hi-Mod LPL, by Sika Corporation.
    b. Eucopoxy LPL, by the Euclid Chemical Company.
    c. Or equal.

D. Epoxy-Cement Bonding Agent:
1. Three-component blended epoxy resin-cement bonding agent.
2. Products and Manufacturers: Provide one of the following:
    a. Sika Armatec 110 EpoCem, by Sika Corporation.
    b. Duralprep A.C., by Euclid Chemical Company.
    c. Or equal.

E. Preformed Expansion Joint Filler:
1. Provide preformed expansion joint filler complying with ASTM D1752, Type I (sponge rubber) or Type II (cork).

F. Joint Sealant and Accessories:
1. For joint sealants and accessories used on isolation joints, control joints, and expansion joints, refer to Section 07 92 00, Joint Sealants.

2.06 GROUT

A. Non-shrink Grout:

1. Pre-packaged, non-metallic, cementitious grout requiring only the addition of water at the Site.
2. Minimum 28-day Compressive Strength: 7,000 psi.
3. Products and Manufacturers: Provide one of the following:
    a. NS Grout by Euclid Chemical Company.
    b. Set Grout by Master Builders, Inc.
    c. NBEC Grout by Five Star Products, Inc.
    d. Or equal.

B. Epoxy Grout:

1. Pre-packaged, non-shrink, non-metallic, 100 percent solids, solvent-free, moisture-insensitive, three-component epoxy grouting system.
2. Minimum Seven-day Compressive Strength: 14,000 psi, when tested in accordance with ASTM C579.
3. Products and Manufacturers: Provide one of the following:
    a. Euco High Strength Grout, by Euclid Chemical Company.
    b. Sikadur 42, Grout Pak, by Sika Corporation.
    c. Five Star Epoxy Grout, by Five Star Products, Inc.
    d. Or equal.

C. Grout Fill:

1. Grout mix shall consist of cement, fine and coarse aggregates, water, and admixtures complying with requirements specified in this Section for similar materials in concrete.
2. Proportion and mix grout fill as follows:
    a. Minimum Cement Content: 564 pounds per cubic yard.
    b. Maximum Water-Cement Ratio: 0.45.
    c. Maximum Coarse Aggregate size: 1/2-inch, unless otherwise indicated.
    d. Minimum 28-day Compressive Strength: 4,000 psi.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR shall examine the substrate and the conditions under which the Work will be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions are corrected.

3.02 FORMWORK

A. Construct formwork in accordance with ACI 347 such that concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Provide openings in formwork to accommodate the Work of other trades. Accurately place and securely support items required to be built into formwork.

C. Clean and adjust forms prior to placing concrete. Apply form release agents or wet forms as required. Re-tighten forms during and after concrete placing, when required, to eliminate cement paste leaks.

D. Removing Formwork:

1. Comply with ACI 301 and ACI 347, except as otherwise indicated in the Contract Documents.
2. Do not remove formwork and shoring until supported concrete members have acquired minimum of 90 percent of specified compressive strength. Results of suitable quality control tests of field-cured specimens may be submitted to ENGINEER for review as evidence that concrete has attained sufficient strength for removal of supporting formwork and shoring prior to removal times indicated in the Contract Documents.
3. Removal time for formwork is subject to ENGINEER's acceptance.
4. Repair form tie-holes following in accordance with ACI 301.

3.03 REINFORCING, JOINTS, AND EMBEDDED ITEMS

A. Comply with the applicable recommendations of Laws and Regulations and standards referenced in this Section, including CRSI MSP1, for details and methods of placing and supporting reinforcing.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials which act to reduce or destroy bond between reinforcing material and concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by means of metal chairs, runners, bolsters, spacers, and hangers, as required.

1. Place reinforcing to obtain minimum concrete coverages as shown on the Drawings and as required in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set with ties so that twisted ends are directed away from exposed concrete surfaces.
2. Do not secure reinforcing to formwork using wire, nails or other ferrous metal. Metal

supports subject to corrosion shall not be in contact with formed or exposed concrete surfaces.

D. Provide sufficient quantity of supports of strength required to carry reinforcing. Do not place reinforcing more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Splices: Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown or indicated for minimum lap of spliced bars, as shown on the drawings.

F. Install welded wire fabric in lengths as long as practical, lapping adjoining sections a minimum of one full mesh.

G. Do not place concrete until reinforcing is inspected and ENGINEER indicates that conditions are acceptable for placing concrete. Concrete placed in violation of this paragraph will be rejected. Notify ENGINEER in writing at least two working days prior to proposed concrete placement.

H. Joints:

1. Provide construction, isolation, expansion, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs-on-grade to stabilize differential settlement and random cracking.
2. In walls, locate joints at a maximum spacing of 40 feet and approximately 12 feet from corners.
3. In foundation slabs and slabs-on-grade, locate joints at intervals of approximately 40 feet.
4. In mats and structural slabs and beams, locate joints in compliance with ACI 224R.
5. Locations of joints shall be in accordance with the Contract Documents and as approved by ENGINEER in the Shop Drawings.
6. Where construction joints are indicated to be roughened, intentionally roughen surfaces of previously-placed concrete to amplitude of 1/4-inch.

I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting diagrams, templates, and instructions provided under other Sections and, when applicable, other contracts for locating and setting. Refer to Paragraph 1.1.B of this Section. Do not embed in concrete uncoated aluminum items. Where aluminum items are in contact with concrete surfaces, coat aluminum to prevent direct contact with concrete.

J. Adhesive Dowels:

1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in hole drilled into hardened concrete. Comply with adhesive system manufacturer's installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following.
2. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Holes shall not be more than 1/4-inch greater than nominal bar diameter, and hole depth shall not be less than twelve times nominal bar

diameter. Hammer-drill holes. Cored holes are not allowed.

3. Embedment depths shall be based on concrete compressive strength of 2,000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.
4. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by ENGINEER.
5. Before setting adhesive dowel, hole shall be free of dust and debris using method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.
6. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.
7. Twist dowels during insertion into partially-filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.04 CONCRETE PLACING

A. Site Mixing: Use drum-type batch machine mixer, mixing not less than 1.5 minutes for one cubic yard or smaller capacity. Increase required mixing time by minimum of 15 seconds for each additional cubic yard or fraction thereof.

B. Ready-Mixed Concrete: Comply with ASTM C94/C94M.

C. Concrete Placing:

1. Place concrete in a continuous operation within planned joints or sections in accordance with ACI 304R.
2. Do not begin placing concrete until work of other trades affecting concrete is completed.
3. Wet concrete and subgrade surfaces to saturated surface dry condition immediately prior to placing concrete.
4. Deposit concrete as near its final location as practical to avoid segregation due to re-handling or flowing.
5. Avoid separation of the concrete mixture during transportation and placing. Concrete shall not free-fall for distance greater than four feet during placing.
6. Complete concrete placing within 90 minutes of addition of water to the dry ingredients.

D. Consolidate placed concrete in accordance with ACI 309R using mechanical vibrating equipment supplemented with hand rodding and tamping, such that concrete is worked around placing and other embedded items and into all parts of formwork. Insert and withdraw vibrators vertically at uniformly-spaced locations. Do not use vibrators to transport concrete within the formwork. Vibration of formwork or placing is not allowed.

E. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

1. In hot weather comply with ACI 305R.
2. In cold weather comply with ACI 306R.

3.05 QUALITY OF CONCRETE WORK

A. Make concrete solid, compact, smooth, and free of laitance, cracks, and cold joints.

B. Concrete for liquid-retaining structures and concrete in contact with earth, water, or exposed directly to the elements shall be watertight.

C. Cut out and properly replace to extent directed by ENGINEER, or repair to satisfaction of ENGINEER, surfaces that contain cracks or voids, are unduly rough, or are in defective in any way. Patches or plastering are unacceptable.

D. Repair, removal and replacement of defective concrete directed by ENGINEER shall be at no additional cost to OWNER.

3.06 CURING

A. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by using moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until formwork is removed. Provide protection, as required, to prevent damage to exposed concrete surfaces. Total curing period shall not be less than seven days. Curing methods and materials shall be compatible with scheduled finishes.

3.07 FINISHING

A. Slab Finish:

1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently. Use a wood float only. Check and level surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture. Slab surfaces shall receive a float finish. Provide additional trowel finishing as required in this Section.
2. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over the surface.
3. Consolidate concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in ten feet when tested with a ten-foot straightedge. Grind smooth surface defects that would telegraph through applied floor covering system.
4. Use trowel finish for the following:
    a. Interior exposed slabs, unless otherwise shown or indicated.
    b. Apply non-slip broom finish, after troweling, to exterior concrete slab and elsewhere as shown.

B. Apply chemical floor hardener to exposed interior concrete floor areas when cured and dry, in accordance with hardener manufacturer's instructions.

C. Formed Finish:

1. Provide smooth form concrete finish at exposed surfaces. Use largest practical form panel sizes to minimize form joints. Exposed surfaces include interior water-contacting surfaces of tanks, whether or not directly visible. All surfaces shall be considered as exposed, unless buried or covered with permanent structural or architectural material. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/8-inch in height. Where surface will be coated or will receive further treatment, remove all fins flush with concrete surface.
2. Provide rough form finish at all unexposed surfaces. After removing forms, patch form tie holes and defects in accordance with ACI 301. Remove fins exceeding 1/2-inch in height.

3.08 GROUT PLACING

A. Place grout as shown and indicated, and in accordance with grout manufacturer's instructions and recommendations. If grout manufacturer's instructions conflict with the Contract Documents, notify ENGINEER and not proceed until obtaining ENGINEER's clarification.

B. Dry-packing is not allowed, unless otherwise indicated.

C. Manufacturers of proprietary grout materials shall make available upon 72 hours notice the services of qualified, full-time, factory-trained employee to aid in ensuring proper use of grout materials at the Site.

D. Placing grout shall comply with temperature and weather limitations described manufacturer's product literature.

3.09 FIELD QUALITY CONTROL

A. Site Testing Services:

1. OWNER will employ testing laboratory to perform field quality control testing for concrete. ENGINEER will direct the testing requirements.
2. Testing laboratory will provide all labor, material, and equipment required for sampling and testing concrete, including: scale, glass tray, cones, rods, molds, air tester, thermometer, and other incidentals required.

B. Quality Control Testing During Construction:

1. Perform sampling and testing for field quality control during concrete placing, as follows:
   a. Sampling Fresh Concrete: ASTM C172.
   b. Slump: ASTM C143/C143M; one test for each concrete load at point of discharge.
   c. Concrete Temperature: ASTM C1064/C1064M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed. Test each load when time from batching to placement exceeds 75 minutes.
   d. Air Content: ASTM C231; one for every two concrete load at point of discharge, and when a change in the concrete is observed.
   e. Unit Weight: ASTM C138/C138M; one for every two concrete loads at point of discharge, and when a change in the concrete is observed.
   f. Compression Test Specimens:
      1) In accordance with ASTM C31/C31M, make one set of compression

cylinders for each 50 cubic yards of concrete, or fraction thereof, of each mix design placed each day. Each set shall be four standard cylinders, unless otherwise directed by ENGINEER.

2) Cast, store, and cure specimens in accordance with ASTM C31/C31M.

g. Compressive Strength Tests:

1) In accordance with ASTM C39/C39M; one specimen tested at seven days, and three specimens tested at 28 days.

2) Concrete that does not comply with strength requirements will be considered as defective Work.

h. Within 24 hours of completion of test, testing laboratory will transmit certified copy of test results to CONTRACTOR and ENGINEER.

i. When there is evidence that strength of in-place concrete does not comply with the Contract Documents, CONTRACTOR shall employ the services of concrete testing laboratory to obtain cores from hardened concrete for compressive strength determination. Cores and tests shall comply with ASTM C42/C42M and the following:

1) Testing of Adhesive Dowels: OWNER will employ testing agency to perform field quality control testing of drilled dowel installations. After adhesive system manufacturer's recommended curing period and prior to placing connecting reinforcing, proof-test for pullout ten percent of adhesive dowels installed. Adhesive dowels shall be tensioned to 60 percent of specified yield strength. Where dowels are located less than six bar diameters from edge of concrete, ENGINEER will determine tensile load required for test. If one or more dowels fail, retest all dowels installed for the Work. Dowels that fail shall be reinstalled and retested at CONTRACTOR's expense.

END OF SECTION

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SECTION 03500 LIFT STATION SPECIFICATION

PART 1 GENERAL

Furnish all labor, materials, equipment and incidentals required to install complete automatic, underground lift stations with all required equipment installed in a polymer concrete wet well and adjacent above-ground valve assembly (and meter). The principal items of equipment shall include two submersible motor-driven sewage pumps, valves, internal piping, automatic pumping level controls, control panel and telemetry (most current model). All materials shall be new, without defects and of the best quality. All materials furnished and all work done shall be in strict accordance with the National Electrical Code and all local requirements and codes.

All lift stations that re-pump sewage from four (4) other upstream lift stations or has a discharge flow 500 gpm or greater shall have an on-site back-up diesel pump equipped with a transducer level controls, and backup float switches. Re-pump station may require an in-line submersible magnetic flow meter (as determined by County), and a force main pressure transducer. Onsite full tanks shall not exceed 540 gallons.

Alternatively, at the discretion of the County, an electric generator equipped with an automatic power transfer switch may be installed.

1.01 STRUCTURES AND EQUIPMENT

A. Pump Station Wet Well.

All wet wells 6 feet diameter and larger, and all pump stations that are owned and maintained by Manatee County, shall be precast polymer concrete, in accordance with Section 03420, designed to accommodate the peak hour development flow from all contributing areas. The wet well shall have a minimum of 4 feet from the lowest invert to the wet well bottom. The pump station wet well size shall be determined using the following formula to determine the minimum volume between the off-level elevation and the influent invert elevation:

MIN. VOLUME (GALS.) = PUMP CAPACITY (G.P.M.) X 4

Wet well diameters shall be 6 feet or larger. 4-foot and 5-foot diameter wet wells shall be used only for special grinder pump applications as approved by the County on a case-by-case basis. The minimum wall thickness for polymer concrete wet wells shall be per Specification Section 03420.

The pump station wet well size and control equipment shall be designed to limit the pumping cycles of each pump to a maximum of 5 starts per hour for duplex stations and 3 starts per hour for triplex stations. Pump stations discharging through pipes 12 inches or larger shall have more than two variable speed pumps. The pump cycle off level shall be no lower than the top of the sewage pumps. The lead pump on level shall be no higher than 18 inches below the invert elevation of the influent pipe for duplex stations, and no higher than 24 inches below the invert for triplex stations.

All pump stations shall have a single gravity-flow influent pipe discharging into the wet well. Multiple gravity pipelines and force mains upstream shall all terminate at a separate polymer concrete manhole before flowing into the pump station wet well. The influent gravity sewer shall be aligned, so that the inflowing stream drops into the front side of the wet well opposite

from the riser side, within an angle of 25 degrees on either side of the centerline passing between both pumps in a duplex station, or between two of the three pumps in a triplex station. As an option to the to the influent gravity sewer main entering the wet well directly between the pumps, a plastic composite/fiberglass drop bowl and pipe (Reliner/Duran, Inc. or equal) shall be installed, as shown on Detail US-20.

B. Above-ground Valve Assembly

An above-ground valve assembly and concrete pad with three gate valves, two weighted lever swing check valves, and a pump-out connection shall be constructed adjacent to the wet well. Tri-plex stations have four gate valves and three check valves. The pump-out connection shall be equipped with a gate valve and an male aluminum quick-coupler; 4-inch for 4 inch or smaller valve assemblies; 6 inch for all others, unless otherwise specified on the plans. All valves shall have factory applied, fusion bonded epoxy coating on interior and exterior. All bolt, nuts & washers in or on the wet well or valve assembly shall be 316 stainless steel

The valve assembly shall be supported by 316 stainless steel adjustable, flange-type, pipe supports anchored to the structure/valve pad. 6-#5 rebar shall be epoxy doweled into the wet well 3-4 inches and cast into the valve assembly slab 3-4 feet.

C. Entrance Hatches

The lift station wet well shall be equipped with an aluminum access cover of adequate size to permit easy removal and installation of sewage pumps and equipment. The wet well access cover shall be a minimum 36" x 48" single (preferred) or double door. The dimensions of the hatch will vary depending on the internal discharge pipe size and internal configuration, the actual required dimensions of the hatch shall be confirmed with the pump manufacturer prior to ordering. The access covers shall be constructed of aluminum with a minimum load rating of 300 lbs/sq. ft. and equipped with 316 stainless steel hinges, a recessed lifting handle which lies flush with the door surface, and a 316 stainless steel staple which may be used to secure the door with a padlock when closed. The doors shall have a raised diamond thread pattern to provide a skid-resistant surface and shall open to 90 degrees and lock automatically in that position, with a handle to release the doors for closing.

D. Sewage Pump Assemblies

Each pumping station shall have a minimum of two identical, totally submersible sewage pump assemblies which are rated and suitable for continuous duty, underwater operation. These units and their associated power and signal cables shall have watertight integrity to a depth of 65 feet. The pump, pump motor and associated components shall all be the products of the same manufacturer. Pump assemblies shall be painted after assembly with an approved air dry enamel which will adequately protect the exterior housings from the corrosive environment in the wastewater sewer system. Coating thickness shall be a minimum of 4 mils.

Pumps shall be selected to operate within 10 percent of the Best Efficiency Point (BEP). The overall lift station system shall be designed to allow for the selected pumps to operate within 10 percent of their BEP.

Factory testing of the pump assemblies shall be required and as a minimum, shall include:

(1) All tests recommended by the manufacturer.
(2) Verify the integrity of assembly and connections (no leaks, tightness of hardware, proper alignment, assembly, etc.) and that the nameplate and specified pump and pump motor (HP, Voltage, Phase and HZ) correspond.
(3) The motor windings and seal housing chambers shall be hi-potted to test for insulation defects and moisture content. Check the resistance of the stator windings with a bridge to verify that the readings of all three phases are basically equal and within tolerance.
(4) Energize pump motor, verify direction of rotation and that it corresponds to the nameplate.
(5) Provide a written report of all testing with the shipped pump.

All pump assemblies shall be warranted against defects in workmanship and materials for whichever is the greater of: a 5-year pro-rated warranty from the date of purchase or as provided in the Defect Security Agreement with the County.

Month 0 –18 = 100% Month 19-31 = 75% Month 32-45 = 50% Month 46-60 = 25%

Pump motors shall have the following electrical characteristics: 230 -volt for 20 HP and lower or 460 –volt for greater than 20 HP, 3 phase, 60 hertz, minimum service factor of 1.15, continuous duty, maximum NEMA LRA/HP code of J, and NEMA Design B. Pump motors shall be non-overloading throughout the entire range of operation. The pump motors are to be induction motors which are built with moisture resistant Class F insulation. Each motor shall be capable of a minimum of 10 starts per hour without degradation of the windings. The pump motor shaft shall be made from a single, solid, forging of 303 (or better grade) stainless steel, tapered, keyed, and supported by a minimum of one heavy duty upper radial ball bearing and a minimum of one heavy duty lower thrust bearing. The bearings shall have a minimum B-10 life rating of 60,000 hours. The shaft and shaft extension shall be of minimum length and maximum diameter to reduce shaft deflection and prolong bearing life. The pump motor shall be designed for pumping at a maximum sump ambient of 40 degrees C (104 degrees F). The stator of the pump motor shall be copper wound (aluminum stator windings are not permitted) and equipped with at least two heat sensors (klixons installed in the stator end turns) which will shut the motor off in case of excessive heat built up. The heat sensors shall be connected in series with the motor starter coil so the starter is tripped if the heat sensor opens. The pump motor housing shall be oil or air filled type for cooling purposes. Oil filled motors shall use pure dielectric insulating oil. The pump motor shall be capable of operating at +/- 10% of rated voltage and +/- 5% of rated frequency without excessive heating. The pump motor shall not exceed a rise by resistance of 90 degrees C at full load over the entire performance curve. It shall be able to operate intermittently a full load while unsubmerged without damage. Power cables and signal cables shall be continuous (without splices from the pump motor to the power supply). Power cables shall be sized for operation at the rated service factor. The power cable shall be a single, multi-conductor, STW-A type that is epoxy potted and compression fitted for water tight sealing into the pump cable entry. As a minimum, the nameplate for the pump motor shall include: MODEL/SERIAL NUMBER, HORSEPOWER, VOLTAGE, FULL LOAD AMPS, FULL LOAD RPM, PHASES, FREQUENCY, NEMA LRA CODE, NEMA DESIGN, INSULATION CLASS, AMBIENT TEMPERATURE, LEAD CONNECTIONS FOR DIRECTION OF ROTATION, TYPE OF DUTY, TYPE OF BEARINGS, and PUMP IMPELLER SIZE. All electrical components used in or in conjunction with the sewage pump assembly shall be UL approved when UL approval is available for that type component.

The pumps shall be capable of pumping raw, unscreened sewage and able to pass a minimum 3-inch solid. Each pump shall have an enclosed cast iron or ductile iron impeller and shall be equipped with a bronze wear ring. The pump lifting cover, stator housing, and volute casing shall be gray cast iron, ASTM A48, Class 30. Castings shall have smooth surfaces that are devoid of blow holes or other casting defects. The pump lifting bail shall have a minimum of 4-inch diameter clear opening and shall be cast as part of the motor cover or fabricated from 316 stainless steel. All fasteners exposed to raw sewage shall be 316 stainless steel. The backside of the impeller shall have pump-out vanes to keep contaminates out of the seal area. The impeller shall be dynamically balanced, and shall be single - or multi-vaned, with an enclosed or recessed, non-clogging design. There shall be a maximum clearance of .125 inches between the seal housing and the top of the impeller. The pump shall have a minimum of two mechanical seals mounted in tandem with an oil chamber between the two seals. The oil chamber of each pump shall be equipped with an electric seal fail sensor which shall be connected to an indicating light at the control panel to annunciate a seal failure and a set of relay contacts for purposes of remote notification via the County RTU system. The unit shall be designed so that when the outer seal fails, the contaminates that enter shall not enter the bearing housing and cause damage to the bearings. The inner seal shall be replaceable without disassembly of the motor housing and without the need for special tools. As a minimum, the rotating seal faces shall be carbon and the stationary seal faces shall be ceramic. All pumps shall be center-line discharge type constructed so that the discharge flange supports the full weight of the pump. Pump assemblies shall be complete with ductile iron or gray cast iron BPIU discharge base elbows that are bolted directly to a base plate which is bolted directly to the wet well floor, guide flange adapter and guide rails. The discharge elbow shall have an automatic coupling end facing the pump and an ANSI Class 125 flanged end ready for connection to the flange of the riser pipe. The design of the pump assembly installation shall be such that the pump will be automatically connected to the discharge piping when lowered into place along the guide rails, and shall seal leak-tight to the discharge base elbow by the weight of the pump assembly resting in the installed position. The pump base elbow shall be mounted on an ASTM A588 (COR-TEN) steel mounting plate that is level and is bolted to the wet well floor using 3/4-inch 316 stainless steel threaded rods with Hilti HVA anchors or approved equal anchors and shall have base ell mounting bolts of 3/4-inch 316 stainless steel that are mounted in place and welded to the plate. The pump guide rails for each pump shall be constructed of two separate whole length sections of 2 inch Schedule 40, 316 stainless steel pipe set 4 inches on center.

The pump assemblies shall be easily removed for inspections or service, requiring no fasteners to be removed or disconnected, and no need for personnel to enter the confined space of the wet well, by simply hauling up on the lift chains. The lifting chains shall be type 316 stainless steel, and shall be 1/4-inch for pumps less than 25 HP and 3/8-inch for pumps 25 HP and greater, or as required by the pump assembly weight. Chains shall be attached to the pump lifting bails using stainless steel shackles and shall extend to the inside top of the wet well. All rails and mounting hardware shall be 316 stainless steel.

E. Riser and Fittings

All force main piping and fittings within the wet well from the pump base elbow to the check valve, shall be DR-11 HDPE; only molded HDPE fittings shall be used upstream of the check valves. The HDPE discharge piping from the pump base ells (in the wet well) and to the valve assembly check valves shall be connected using HDPE flange adapters with 316 stainless steel backup rings. No ductile iron bodied fittings shall be located between the pump base elbow and the check valves. All HDPE connections shall be thermal fused. All

piping downstream of the tee/cross in the valve assembly to the first underground fitting shall be ductile iron pipe, after which PVC DR-18 shall be used.

All flanged fittings shall use 316 stainless steel bolts, nuts and washers. All threads shall be treated with Bostik Never-Seez anti-seizing compound or approved equal. All bolts on the flange connection at the pump base ells shall have two nuts with a lock washer between them or a nylon lock nut.

All stainless steel fasteners shall be treated with Never-Seez prior to assembly and torque according to the fitting manufacturer's recommendation.

The riser pipes shall be attached to riser pipe brackets by 316 stainless steel U-bolts. The U-bolts shall be tightened to secure the riser pipe as to grip the pipe without deforming the pipe when bolted to the brackets. The riser pipe brackets shall be constructed of 316 stainless steel 2 inch tubing (or 2 inch 316 stainless steel angle) with 6"x6"x1/4" 316 stainless steel plates welded to each end and attached to the wet well walls by two (min) 316 stainless steel anchors.

F. Hardware

A multi hook stainless steel hanger shall be installed inside the wet well access opening for supporting the float switches and pump electric cables. The multi hook hanger shall be constructed from 1/4-inch x 2-inch type 316 stainless steel flat stock with individual hooks constructed of ¼-inch type 316 stainless steel rod stock. Individual hangers shall be installed on each side of the upper guide rail bracket for each pump to support the pump lifting chain and power cable. The lifting chain hook shall be constructed from 3/8-inch type 316 stainless steel rod stock. The pump power cable hook shall be constructed from 1/4-inch x 1-inch type 316 stainless steel flat stock.

G. Painting and Coating

All paint and other coatings shall be applied in accordance with the product manufacturer's specifications for the surfaces being coated. All ductile iron body valves shall have a factory applied fusion bonded epoxy coating inside and outside. All ductile iron fittings shall have an approved factory applied epoxy coating inside and outside. No field-applied paintings or coatings shall be applied to the valves or fittings.

H. Stilling Well (where required)

A stilling well may be required, and if so, shall be a 6" PVC stilling well mounted such that the top is available to an open hatch cover. The bottom of the stilling well shall have two 316 stainless steel bolt all the way through both sides, passing through the center of the pipe, approximately 4" from the base of the pipe. It shall have 1/2-inch diameter holes drilled around the circumference at a rate of one hole per inch of length for at least the full wetted height. All mounting hardware shall be 316 stainless steel.

I. Magnetic Flow Meter (where required)

A flow meter may be required, and if so, shall be rated for continuous submergence, 0.05% accuracy with a polyurethane liner, flush electrodes, FM Class 1, Division 2, Groups A, B, C & D and shall be constructed for a flanged mount. Meter shall be supplied with a like size spool piece. The exterior control module/transmitter shall be mounted either inside or adjacent to the lift station control panel on the same support structure per the Lift Station

Supervisor.

2.01 ELECTRICAL

A. Service and Metering

The Contractor shall be responsible and shall pay for any permits, fees, and inspections required by the local power company for service installations. Three phase power shall be used unless otherwise approved by the County. Service for pump motors of 20 horsepower or smaller shall be 230 volts. For motors greater than 20 horsepower, the service voltage shall be 460. No phase converters will be accepted. All lift stations shall be equipped with a knife-type fused safety switch in a NEMA 4X stainless steel enclosure, lockable in the ON and OFF position, between the service meter and the control panel to permit servicing of the main breaker without removing the service meter. All meter bases shall be aluminum. Minimum service size shall be 100 amp. Conduit connections to the disconnect shall be sealed using Myers conduit hub connectors (disconnect side).

B. Conductors

All power conductors shall be single conductor, 600 volt, type THW or THHN stranded copper. Minimum conductor size shall be #12 AWG. ALUMINUM WIRE IS NOT PERMITTED. All control wiring shall be single conductor #14 AWG, 600 volt, type THHN stranded copper. All terminations and interconnections of control wiring shall be by means of compression-type lugs of the nylon self insulated type with an inner bronze insulation grip sleeve on identified terminal strips. All control wiring shall be color coded as indicated on the standard details.

C. Conduit

All power conductors from the utility source to the service meter shall be enclosed in PVC Schedule 80 conduit below ground and aboveground (NO I.M.C. ALLOWED). All lift stations shall be equipped with one conduit to the wet well for each pump power cables and a separate conduit to the wet well for the control (floatball) and signal cables. In lift stations with large horsepower pumps and pumps equipped with sensor cables, the conduit size and quantity shall be determined by the County. All conduit to the lift station wet well shall be minimum 2" Schedule 80 PVC and shall be run by the shortest route possible. All terminations shall be made inside the electrical control panel. All flexible conduit shall be non-metallic.

D. Control Panel

All pump stations shall have one automatic control panel, one telemetry control unit enclosure with specified TCU (most current model) with assigned radio frequency and one junction control box for motor control, floats, seal fail and transducer. The control panel will be ordered through Barney's Pump of Lakeland, FL. The Data Flow Systems (DFS), part# RJ1816HPL telemetry control cabinet shall be relocated to the new electrical building. Specify if 480V 3 phase is needed. Enclosure must be ordered with 'NO" tower mounting brackets.

All cabinets shall be white in color unless specified otherwise. The 304 S.S. control cabinet and junction box shall be powder coated white.

The Order Numbers and specification are listed below.

Barney's Pumps approved panels by Manatee County

Part#	STD. FLA	MCB/ECB	PCB	Starter	Size (Starter or OL)	Note:
ManCoCP240_1_3_VFD	24 (Input)	100	40	FRN003E1S-7U	N/A	11A Max Pump FLA (VFD)
ManCoCP240_1_5_VFD	42.7 (Input)	125	70	FRN010E1S-2U	N/A	19A Max Pump FLA (VFD)
ManCoCP240_3_2_SSC	8.3	100	15	SSR	3-12A	Solid State Starter
ManCoCP240_3_3_SSC	9.5	100	15	SSR	3-12A	Solid State Starter
ManCoCP240_3_5_SSC	15.3	100	25	SSR	10-40A	Solid State Starter
ManCoCP240_3_7.5_SSC	25.2	100	40	SSR	10-40A	Solid State Starter
ManCoCP240_3_10_SSC	29.5	100	50	SSR	10-40A	Solid State Starter
ManCoCP240_3_15_SSC	44.2	125	70	SSR	25-100A	Solid State Starter
ManCoCP240_3_20_FVNR	54.4	175	90	14HUG32AF	Size 3	Elect-mech starter
ManCoCP240_3_25_FVNR	68	200	100	14HUG32AF	Size 3	Elect-mech starter
ManCoCP480_3_2_SSC	4.1	100	15	SSR	3-12A	Solid State Starter
ManCoCP480_3_3_SSC	4.8	100	15	SSR	3-12A	Solid State Starter
ManCoCP480_3_5_SSC	7.8	100	15	SSR	3-12A	Solid State Starter
ManCoCP480_3_7.5_SSC	12.6	100	20	SSR	10-40A	Solid State Starter
ManCoCP480_3_10_SSC	14.7	100	25	SSR	10-40A	Solid State Starter
ManCoCP480_3_15_SSC	22.1	100	40	SSR	10-40A	Solid State Starter
ManCoCP480_3_20_SSC	27.2	100	50	SSR	10-40A	Solid State Starter
ManCoCP480_3_25_SSC	34	100	60	SSR	10-40A	Solid State Starter
ManCoCP480_3_30_SSC	40.1	110	70	SSR	25-100A	Solid State Starter
ManCoCP480_3_40_FVNR	52.2	125	80	14HUG32AF	Size 3	Elec-mech Starter
ManCoCP480_3_50_FVNR	70.5	175	110	14HUG32AF	Size 3	Elec-mech Starter

All part numbers include junction box
Fuji Inverters/VFD's only
Part number for cabinets that are single phase does not include inverters - sold seperately.

The control panel, telemetry control cabinet, and motor cable junction box along with the safety switch box and electric utility power meter, shall be attached to horizontal support channels with stainless steel fastening systems designed for use with the support channel. The horizontal channels shall be 1-5/8 inch, 12 gage (or thicker) solid stainless steel channels (Uni-strut, B-Line or County approved equal), attached with stainless steel 3/8-inch all thread rod with stainless steel flat washers and nuts to two vertical 3 inch diameter stainless steel, schedule 40 posts. The 3 inch vertical pipe shall have plastic end caps or stainless steel end caps at the top and shall be anchored in concrete adjacent to

the pump station wet well. See County Standard, “Sewage Pump Station Meter & Electrical Details”. No fittings shall enter from the top or back of the control panel. All fittings shall enter the side or bottom of the control panel and shall penetrate the control panel with Myers Hubs.

The overall control panel shall be a minimum of 30"x 36"x 12" deep and of adequate size to completely cover (without crowding) all wiring and components mounted inside it. It shall have provisions for the mounting of all basic and optional controls and instrumentation. Install engraved nameplates defining door mounted hardware. The electrical control panel shall have a complete wiring schematic which is laminated in plastic and attached to the inside of the outer control panel door.

All components shall be installed per the most current NEMA and NEC regulations and standards. The components shall be industrial NEMA rated (I.E.C. is not acceptable) and UL approved when UL approval is available for that particular type component. The components of the panel shall be held in place with stainless steel, slotted, plan head machine screws with star type washers. The panel shall be tapped to accept the mounting screws of the components and no self-tapping type screws shall be used. The control panel shall have the following items installed on the back plane or on aluminum “high hats” attached to the back plane, so the body of the component is flush with the dead front door to allow operation and reset of the components without opening the dead front door: main power breaker, emergency power circuit breaker, individual pump circuit breakers, control circuit breaker and G.F.I. duplex receptacle circuit breaker. The control panel shall have the following items installed directly to the back plane: individual motor starters, power distribution blocks, neutral bar assembly, grounding bar/lugs, terminal strips, 2 inch PVC panduit for control and telemetry wiring and fuses, and surge suppressor. The control panel shall have one G.F.I. duplex receptacle installed on the dead front door. The exterior of the control panel shall have one emergency generator receptacle, one flashing red light, and one audible alarm with reset button. The individual placement of all the components of the control panel shall be installed as indicated in the standard details.

E. Ratings

The controls shall be rated for the supply voltage (230 or 460 volts), 3 phase, 60 hertz. In the event that three phase power is not available at the location of the control panel, the cabinet shall be either ManCOCP240 1 3 VFD (3 hp) or ManCoCP240 1 5 VFD (5 hp) inverters. All control voltage to the wet well shall not exceed 24 volts DC.

F. Wiring Method

All power conductors from the main circuit breaker to all other circuit breakers shall be connected via a Square D model LBA363206, Marathon #1333555, or equal power distribution block. All electrical panel components shall have individual neutral wires. All neutral wiring shall be connected via a Square D model SN12-125 neutral assembly. Wiring is to be continuous with no splices between connections. Provide a Square D model PK9GTA grounding bar at the bottom of the backplate. This grounding bar will be the central connection point of all ground wires for the system with the exception of the pump power cords and surge arresters. The pump power cords and surge arresters shall be grounded via individual ground lugs that are to be attached to the control panel back plane. Provide two 12 terminal, Ideal Model 89-208 terminal strips to make electrical connections in the control panel. One terminal strip shall be used exclusively for 24 volt connections (TB-1) and the other shall be used exclusively for 120 volt connections (TB-2). The power distribution block, neutral assembly, grounding bar and terminal strips shall be located as

indicated in the standard details. Use stainless steel screws and fasteners for all wiring connections.

G. Circuit Breakers

The panels shall be equipped with main and emergency circuit breakers for a minimum size of service of 100 amps. The main and emergency circuit breakers shall be interlocked so that when one is in the open position, the other circuit breaker must be in the closed position. There shall also be an individual circuit breaker for each pump, a control circuit breaker, a 20 amp circuit breaker for site lighting, a 20 amp circuit breaker for the flow meter (re-pump stations only) and a minimum 20 amp circuit breaker for the 120 volt GFI protected convenience outlet that is mounted on the inner control panel door. All circuit breakers shall be mounted in the control panel per the standard details. The circuit breakers shall be of the heavy duty thermal magnetic trip variety. For circuit breakers up to 100 amps, use Square D series QOU or County approved equal. For circuit breakers greater than 100 amps, use Square D "Mag Guard" series with adjustable trip for the pumps, main and emergency breakers shall be Square D QBL, HGL, or JGL.

H. Motor Starters

Pump motors shall each have a NEMA-rated, solid state or magnetic starter sized as called for on the construction plans. No starter smaller than NEMA size 1 shall be used. Starters shall be solid state, full voltage, non-reversing type. These starters shall be Siemens series ESP-100 or County approved equal with special phase loss protection and a special factory coating of the solid state circuit boards which prevents hydrogen sulfide damage. The starters shall be equipped with under voltage release and overload protection on all three phases. The motor starter contacts (if used) shall be constructed so that they may be easily replaced without removing the starter unit from its mounted position. The overload reset device shall be operable without having to open the inner swing panel.

I. Lightning Arresters

There shall be a Ditek DTK Series lightning arrester/surge suppressor installed on the incoming power source. It shall be mounted on the bottom exterior or placed inside of the safety switch enclosure and connected to the LOAD SIDE of the safety switch and overload reset.

The main circuit breaker and the RTU circuit breaker shall also each have a Ditek CM+Series lightning arrester/surge suppressor connected to the load side of the breaker wiring. These lightning arresters/surge suppressors shall be mounted with the supplied adhesive strip on the back of the "high hat" supporting the breakers. The exact model lightning arresters/surge suppressors shall be based on the voltage and number of phases of the protected circuits.

J. Liquid Level Switches and Sensors

A minimum of four float switches are to be installed in the wet well to monitor and control liquid level height. The switches shall be a single pole mechanical type switch (as manufactured by MDI, Connery Manufacturing, or County approved equal). They shall be designed to actuate when the longitudinal axis of the float is horizontal, and deactuate when the liquid level falls one inch below the actuation elevation. The switching arrangement shall be normally open when deactivated. The output leads shall be connected in the control panel as shown in the standard details. The control voltage to the level switches shall be 24

volts DC and the switches shall be sized to operate at that voltage. In addition to the above, pump stations that re-pump sewage flows (directly or indirectly) from other pump stations shall have a Dylix model GXS3-PP300-A49-B49(50)-C01 pressure transmitter mounted inside a stilling well as the primary level sensor.

The wiring connecting the cable junction box to the wet well floats shall be a continuous length (no splices) of flexible rate 600 volt, minimum diameter of #18, type S.O. cable. The float switches shall have all connections made inside the junction box using crimp on spade terminals that are landed to the terminal strip. The wiring shall be installed so there is a minimum of four feet, and a maximum of 6 feet, of excess cable in the wet well for relocation of the float switches.

K. Alarms

Each pump station shall have one flashing red light to signal high level conditions. A flasher unit shall be installed and mounted in the control panel enclosure to operate the led flashing light attached to the unistrut.

L. Generator Receptacle

A generator receptacle to permit the installation of a portable emergency generator as the power source when the local utility power company power supply is lost shall be installed on the outside of the control panel as indicated on the standard details. It shall be directly connected to the emergency circuit breaker inside the control panel. The emergency and main circuit breakers shall have a mechanical interlink between them which shall allow only one source to supply power to the control panel at any given period of time. The generator receptacles shall be:

Power Supply	Required Receptacle
0-100 Amp, 230 Volt	Russell Stoll JRSB1044FR
100-200 Amp, 230 Volt	Russell Stoll JRSB2044FR
0-200 Amp, 460 Volt	Russell Stoll JRSB2034HR

M. Seal Leak Moisture Detector

Provide for each pump a moisture sensing sensor which will detect when moisture has penetrated the seal chamber. The moisture seal detector shall be connected to the County RTU system to notify lift station maintenance personnel when a seal has allowed moisture to enter the oil chamber of the pump. An indicating lamp is to be mounted in the control panel as illustrated in the standard details to also signal the seal failure.

N. Telemetry Control Unit

The remote terminal/pump control unit shall be a complete TAC Pack TCU system as manufactured by Data Flow Systems, Inc. The unit is to be a fully programmable, dual function device. It shall be used to monitor and control SCADA equipment and it shall have all the necessary hardware and software to control three pump motor starters. Its operation is based on level inputs from a minimum of four float ball switches in the wet well. It shall have the ability to control pump alternation, activate and deactivate remote and local alarms, and communicate with the HT3 SCADA System. It shall be equipped with RTU surge protection and a transient filter shield. The unit shall have an uninterruptible power source and contain all the components and be electrically connected as indicated in the standard details. It shall be equipped with an antenna tower with supporting mast and coaxial cable

that is required by the manufacturer for that particular system. The battery backup will be contained with the TCU in its own enclosure. The installation shall include the required FCC licensing. The antenna and mast shall be rated for 150 MPH winds. Tower heights above 20 feet must be Rohn RG-45 series.

Pump stations that re-pump sewage flows (directly or indirectly) from other pump stations will also require an Analog Monitor Module to receive input from the force main pressure transducer and flow meter.

Telemetry control and remote terminal/pump control units are not required for privately owned and maintained pump stations.

O. Grounding

Install a 5/8" x 10' copper-clad ground rod for each electrical service. Connect to the ground rod a #6 bare copper wire to connect with the electrical panel grounding bar. Provide another, separate ground rod, tower clamp, and #6 bare copper wire to connect directly to the antenna tower, control cabinet/TCU cabinet, polyphaser, and ground. The ground rods and #6 bare copper wires shall be connected by a exothermic weld (cad weld).

P. Site Lighting

A minimum 6000 lumins LED shall be mounted on the system tower for illumination of the pump station area. The manually operated light shall be mounted on 3/4-inch aluminum rigid conduit connected to the RTU tower using 90 degree korns clamps.

3.01 GRINDER PUMP (LIFT) STATIONS

A. Grinder pumps shall be used where the required discharge rate is low and the discharge pipe is required to be smaller than 4-inch diameter. Grinder pumping stations shall be constructed essentially to the same standards as the larger standard pumping stations, with full plastic liners, dual pumps with guide rails, control panels, RTUs, antennas and masts, etc., but sized smaller to accommodate the lesser capacity. Wet well diameters may be smaller than 6 feet, but shall be no smaller than 4 feet. Riser pipes shall be no smaller than 1.25 inches diameter, and force mains shall be no smaller than 2 inches diameter. Ball check valves shall not be used.

B. Grinder pumps will not be required to pass a 3-inch solid, but shall rather be capable of grinding all materials normally found in domestic raw wastewater into a pumpable slurry. The grinder cutters shall be made of 440C stainless steel hardened to Rockwell 60C. Motors shall be 230 volt, 3 phase, 60 hertz, 3450 or 1750 RPM speed, and shall otherwise meet the same requirements as for the larger standard sewage pump motors. Minimum hatch cover sizes for grinder pump station wet wells shall be 30 x 36 inches.

C. There shall be an approved shut-off valve (tapping gate valve) installed at the connection of a grinder pump station pipeline to a County force main, and where the grinder pump station is maintained by a private entity, there shall be another approved shut-off valve (gate valve) installed at the point where the grinder pump pipeline enters the public right-of-way or public utility easement. The force main shall be at least 18 inches below the top slab within the valve vault. A 90 degree bend, which is turned down, shall be installed 18 inches outside of the valve vault to lower the force main to obtain a minimum 3 feet of cover.

Wet wells and valve vaults for grinder lift stations may be fiberglass or HDPE plastic. If fiberglass, the resins used shall be a commercial grade unsaturated polyester or vinyl ester resin. The reinforcing materials shall be commercial Grade "E" type glass in the form of continuous roving and chop roving, and shall have a coupling agent that will provide a suitable bond between the glass reinforcement and the resin. The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inches thick. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5 inch (13 mm) to maximum length of 2.0 inches (50.8 mm) and shall be applied uniformly to an equivalent weight of 3 oz/ft_2. Each pass of chopped roving shall be well-rolled prior to the application of additional reinforcement. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inch (2.5 mm). The interior surface shall be free of crazing, delamination, blisters larger than 0.5-inch in diameter and wrinkles of 0.125-inch or greater in depth. Surface pits may be permitted if they are less than 0.75-inch in diameter and less than 0.0625-inch deep. Voids that may not be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 0.5-inch in diameter and less than 0.0625-inch thick. After inner layer has been applied, the wet well and valve vault wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. Wet well and valve vaults may require resin fiber-reinforced bottoms.

Wet well bottom shall have a minimum 3-inch anti-flotation ring. Wet well and valve vault bottom shall be designed to resist all pressures induced by water, soil and wheel loads with a maximum deflection of 1/4-inch.

No hardware shall penetrate the wet well walls. The wet well wall shall include built / molded in channel supports for every 8 feet of vertical discharge piping for mounting pipe support braces and for mounting both guide rails and hooks to hang float balls, pump lifting chains, etc. at the top of the wet well. All pipe openings shall have resilient pipe to wet well seals.

The 1:1 bottom fillet may be molded or formed fiberglass or plastic or concrete. Concrete also may be used on the top of anti-flotation ring and as required to resist buoyancy. The wet well and valve shall resist flotation with ground water level assumed to be at finished grade. The Engineer of Record shall submit flotation calculations to Manatee County when submitting Construction Drawing approval.

All fiberglass and plastic wet wells and valve vaults located such that a vehicle may run over it shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM D3753. To establish this rating, the complete wet well and valve vault shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lbs. Thickness of fiberglass and plastic wet wells and valve vaults shall be determined by calculations submitted when submitting construction drawings for approval. The Engineer of Record shall perform the calculations or shall submit a certification that he or she reviewed calculations prepared by others and that the aforementioned requirements have been met.

The wet well cylinder shall have the minimum pipe-stiffness values shown in table below when tested in accordance with ASTM D3753 Table 1.

WET WELL LENGTH (FT.)	PIPE-STIFFNESS F/AY, [PSI (k Pa)]
3 - 6.5	0.72 (4.96)
7 - 12.5	1.26 (8.69)

13 - 20.5	2.01 (13.86)
21 - 25.5	3.02 (20.82)
26 - 35	5.24 (36.13)

The exterior surface shall be relatively smooth with no sharp projections, free of blisters larger than 0.5-inch in diameter, delamination or fiber show.

Each wet well and valve vault shall be designed and built to meet all required ASTM D3753 designations for dimensional requirements, hardness, chemical resistance, and workmanship. Test records shall be provided to the County.

The Contractor shall set sections vertical and in true alignment. The finished wet well and valve vault shall not be out of plumb by more than 3/8-inch per 10 feet of height.

Each wet well and valve vault shall be marked on the inside and outside with the following information: Manufacturer's name or trademark, factory location, serial or model number and total length.

4.01 WATER SERVICE

All pump stations shall be equipped with a 3/4-inch water service (hose bib). Each water service shall be equipped with a 5/8-inch water meter, a reduced-pressure principle backflow prevention assembly (Wilkins 975XL2, Apollo RPLF4A, or Equal) and a 3/4-inch brass hose bib. The water meter and backflow prevention assembly shall be located within two feet of the pump station easement (or property) line. All water meters shall be obtained from the Manatee County Water Meter Department. Reclaimed water shall be used where available.

5.01 PERMITS

The Contractor shall be responsible for obtaining and shall pay for any permits and/or inspections required.

6.01 SHOP DRAWINGS AND INSPECTIONS

When calling for inspection, the Contractor shall have these approved shop drawings available on-site for review by the inspectors. The Contractor shall also deliver to the Lift Station Section inspector, the pump manufacturer's technical manual with the model number, serial number, and certified pump curve, for each pump prior to acceptance by the County for maintenance.

7.01 EASEMENTS

An easement for ingress and egress to the lift station and an easement for the lift station must be granted and recorded before the lift station can be accepted by the County for operation and maintenance.

8.01 SITING

A. The siting of all pump station facilities shall be subject to review and approval by Manatee County. All pump stations shall be located on a separate parcel of land or within a utility easement in common open space. The station shall be properly sited with due consideration of the neighborhood, surrounding site features, landscaping, aesthetics, safety and security.

The station and associated landscaping shall not be sited on a right-of-way, private road, median, front yard of a residence, or within a visibility triangle. The pump station wet well, valve vault, control panel, and telemetry antenna shall not be sited within 20 feet of overhead power lines.

B. Each pump station site shall have a vehicular access drive paved with a concrete surface course over a base course. The drive shall be designed to allow a service truck to park off of the right-of-way or roadway easement and to also allow the service truck to back up to the wet well such that the wet well is directly to the rear of the truck or adjacent to the side of the truck. The pump station control panel, telemetry antenna and hose bib shall not be located between the vehicular access driveway and the wet well, valve assembly, and/or valve vault.

C. There shall be at least a 20-foot easement in all directions from the pump station site equipment. There shall be no obstructions within the easement such as buildings, walls, fences, etc., other than those that are part of the pump station and identified in these standards. A minimum setback of 5 ft shall be provided between pump station structures/equipment and the security fence. Pump station easement shall extend a minimum of 15 ft beyond all four sides of the security fence. If the pump station is adjacent to the street's right-of way, the pump station easement shall extend to the ROW line. The lift station site shall be made accessible with a minimum 30 ft wide corridor/easement.

D. Surface stormwater flow shall be directed around the pump station site. The site shall be graded to provide sheet flow of site runoff away from the equipment and direct it to a suitable swale or drainage outfall. The construction drawings shall include a pump station site plan with a grading plan and landscaping plan.

9.01 FLOODING

Wastewater pumping station structures and electrical and mechanical equipment shall be fully protected from physical damage from flood water intrusion by the 100-year flood. Wastewater pumping stations shall remain fully operational and accessible during the 25-year flood. Regulations of state and federal agencies regarding obstructions of the pumping station site by flood waters shall be observed during the design of the development.

10.01 ENTRANCE HATCH ELEVATIONS

The wet well and valve vault top and entrance hatches shall be set at least 4 inches above the 100-year flood plain elevation, or 8 inches above the 25-year flood plain elevation, or 6 inches above the surrounding grade, or 12 inches above the adjacent roadway crown elevation, whichever is highest. Where this is not practical, deviation from the above must be approved by the County on a case-by-case basis.

11.01 ACCESSIBILITY AND SECURITY

The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. A fully functional paved travelway shall be provided to the lift station driveway. The facility shall be located off the traffic way of streets and alleys.

All hatches, electrical panel and irrigation panel doors shall be provided with lockable hasps or staples.

Security fences with lockable gates shall be provided for all lift stations that are owned and maintained by Manatee County. Lift stations shall have a 6-foot high vinyl coated chain link security fence with privacy decorative slatting (color matched). Chain link security fencing shall be #9 gauge core, galvanized with vinyl coating, with 1 5/8 inch top rails, 2 3/8 inch Schedule 40 line posts, 2 1/2 inch Schedule 40 corner posts and 3 1/2 inch Schedule 40 gate posts for swing gates. Gate posts and track line posts shall be 4 inch Schedule 40 for cantilever slide gates. Maximum line posts spacing shall be equally spaced, not to exceed 8 feet.

For private lift stations, the Engineer of Record shall evaluate the location of the proposed lift station and determine whether a security fence is necessary.

12.01 FORCE MAIN FLOW METER

Lift stations that re-pump sewage flows (directly or indirectly) from other lift stations shall be equipped with a submersible electromagnetic flow meter. The flow meter shall be mounted on an above-ground force main. The flow meter shall be a McCrometer Ultra Mag Model UM06 or an approved equal. The meters, gauges and all connections and wiring shall be rated fully submersible. The flow meter shall transmit 4-20 mA signals to the telemetry system via the Analog Monitor Module mounted inside the control panel. The signal cables shall be run through 1-inch PVC conduit from the meter to the control panel. The meter display unit shall be weather-proof and mounted on an aluminum stand adjacent to the meter.

13.01 LANDSCAPING & IRRIGATION

A. Landscape trees and shrubs.

The pump station site shall have shrubs planted around the perimeter of the pump station security fence in a hedge-like placement. Shrubs shall have a minimum spacing of 3 feet between the centers of the shrub's base stem. For private pump stations that are located in nonresidential areas, shrubs are optional for the sides that are not adjacent to thoroughfare roads, nonthoroughfare roads, and residential areas. For pump stations that are located adjacent to thoroughfare roads and non-thoroughfare roads, a minimum of two small understory trees or palm trees shall be planted between the pump station security fence and the right of way line. For pump stations within residential areas or located adjacent to residential areas, a minimum of two additional understory trees or palm trees; for a total of at least four understory trees or palm trees shall be planted around the pump station (these landscaping requirements are not applicable to pump stations that only serve one single family residence.) A minimum setback of 5 feet shall be provided between the shrub's base stem and the security fence to provide an access way for service personnel. A minimum setback of 10 feet shall be provided between the trunk of understory trees/palm trees and the security fence.

Understory trees shall not have a mature height exceeding 30 feet. Small understory trees, palm trees and shrubs shall not have evasive roots. The minimum height of understory trees shall be six (6') feet at time of placement. The minimum height of palm trees shall be fifteen (15') feet at time of placement. The minimum height of shrubs shall be two (2') feet at time of placement. Shrubs shall have three gallon root balls. Shrub growth habits shall be upright, globose, or columnar. Shrub growth habits shall not be spreading or broad spreading. The understory trees and palm trees shall be planted to accent the shrub placement. Tops of root balls of plants shall be set at or slightly above existing grade. All plant material to be Florida Grade #1 or better, as defined in "Grades and Standards for Nursery Plants," State

of Florida Dept. of Agriculture. Plants shall be sound, healthy, vigorous, and free from plant diseases, insects, pests, or their eggs and shall have healthy normal root systems. Plants shall be nursery grown stock, freshly dug. No heeled in, cold storage, or collected stock shall be accepted. Ground covers shall have sturdy fibrous root systems. Staking and bracing shall be done on all trees using Arbor tape and the Duckbill anchor system, in accordance with sound nursery practices.

The shrubs, understory trees and palm trees shall be of the drought tolerant, low maintenance varieties. Plant selection shall be based on soil water retention as well as soil pH.

Examples of acceptable vegetation are as follows:

	SOIL CONDITIONS WHERE PLANT WILL GROW		pH RANGE	
PLANT NAME	Damp to poorly drained soils w/ low percolation	Well drained sands w/ high percolation	Plant tolerates acidic & alkaline soils	Plant tolerates acidic soils only
UNDERSTORY TREES (Mature height not exceeding 30 feet)				
Little Gem Magnolia (Magnolia grandiflora)	X			X
Southern Wax Myrtle (Myrica cerifera)	X	X	X	
Peregrina (Jatropha intergerrima)		X	X	
Bottle Brush Tree (Callistemon citrinus)		X		X
Crape Myrtle Tree (Lagerstroemia Indica)		X		X
Feijoa (Feijoa sellowiana)		X	X	
PALMS				
Cabbage Palms (Sabal palmetto)	X	X	X	
Pindo Palms (Butia capitata)		X	X	
Dwarf Royal (aka Christmas) Palm (Veitchia merrillii)		X	X	
SHRUBS & BUSHES				
Cocoplum (Chrysobalanus icaco)		X	X	
Pipestem (Agarista Populafollia)	X	X	X	
Sweet Viburnum (Viburnum odoratisimum)		X	X	
Yew podocarpus (Podocarpus macrophyllus)		X	X	

The following plant species shall not be planted at the lift station site:
Melaleuca quinquenervia (commonly known as Punk tree, Malaleuca); Schinus terebinthefolius (commonly known as Brazilian Pepper); Casuarina species (commonly known as Australian Pine); Rhodomyrtus tomentosa (commonly known as Downy Rose

Myrtle); Mimosa pigra (commonly known as the Catclaw Mimosa); Dalbergia sissoo (commonly known as the Indian Rosewood); and Cupaniopsis anacardioides (commonly known as the Carrotwood).

B. Ground cover.

There shall be no vegetation within the lift station fencing. Site shall include a polypropylene weed barrier fabric that is covered with a minimum of 2-inches of washed shell, or rock within lift station fencing. Landscaping stones shall be inert and nonleaching. Crushed lime rock shall not be acceptable. Site shall include a polypropylene weed barrier fabric that is covered with 3 to 4-inches of shredded wood-type mulch that is located under the shrubs and up to the outside of the security fence. Polypropylene weed barrier fabric that is covered with 3 to 4-inches of shredded wood-type mulch shall be located under the trees for a minimum distance of 3 feet from the tree. Bahia, St. Augustine or Floritam sod or shredded wood-type mulch with a polypropylene weed barrier fabric shall be extended from the shrubs to the lift station easement line.

C. Irrigation.

An irrigation system shall be connected to a non-potable water source. A weather-tight time clock with built-in transformer, minimum of four zones (Rainbird ESP-4M, Toro CC-M-9, or equal) and a rain sensor (Mini-Clik, or equal) shall be furnished and installed. The irrigation controller shall be in a lockable control panel and attached with stainless steel two piece pipe clamps or stainless steel U-bolts to two vertical 3 inch diameter stainless steel, schedule 40 pipes or equal pipe support. The pipe clamp or U-bolt ends shall be covered with plastic caps to prevent injury to personnel. The 3 inch vertical pipe shall have plastic end caps or stainless steel end caps at the top and shall be anchored in concrete. The irrigation system control panel recommended location is outside of the fence and behind the shrubs. The Contractor shall furnish the County a padlock with a set of two keys for the irrigation control panel. The number of zones shall be based on the proposed site, planting configuration, watering distribution, irrigation system demand, and type of vegetation to be irrigated. The irrigation system shall be installed to irrigate the trees, shrubs and grassed areas; and designed to provide three-fourths (3/4") to one (1") inch of water per week and be in conformance with irrigation restrictions established by the Southwest Florida Water Management District (not restricted if using reclaimed water). The irrigation system shall adhere to the requirements of the Manatee County Land Development Code and to the "Standards and Specifications for Turf and Landscape Irrigation Systems", latest edition, as published by the Florida Irrigation Society, Inc. A permanent sprinkler system with distribution lines underground with mist and/or bubbler nozzles, as appropriate, above the ground are acceptable. A micro-irrigation system located within the planting beds of shrubs and trees is acceptable for that type of installation. In each accent, isolated or separate tree planting bed, a tree bubbler (Toro 514-20 or equal), shall be installed at each tree. In addition, a four (4') foot section of flexible PVC shall be provided for the tree bubbler at each tree. Drip line hoses shall have built-in emitters (Toro DL2000 or equal).

D. Radio signal interference.

Landscape buffer plantings are to be field adjusted in coordination with the siting of the lift station's radio antenna to eliminate signal interference. The antenna for the existing or proposed radio telemetry unit at the lift station requires direct line-of-sight signaling capability to the Utilities Department office that will receive the signal. There shall be an unobstructed horizontal angle of fifteen (15°) degrees from the antenna mast (7 1/2 degrees on both sides of the direct line-of-sight azimuth). No tree shall be planted within the

designated unobstructed angle for a twenty (20') foot horizontal distance measured from the mast.

14.01 BACK-UP DIESEL PUMPS OR EMERGENCY GENERATOR SET

Back-up Diesel Pumps:	See Section 11215
Emergency Generators:	See Section 16231

END OF SECTION

SECTION 05100 STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Structural metals consisting of standard shapes, hollow sections, fasteners, rods and plates that are used in structural supports and connections.

1.02 RELATED SECTIONS REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
Aluminum Design Manual	The Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AISC 201	AISC Certification Program for Structural Steel Fabricators
AISC 303	Code of Standard Practice for Steel Buildings and Bridges
AISC 341	Seismic Provisions for Structural Steel Buildings
AISC 360	Specification for Structural Steel Buildings
AISC 810	Erection Bracing of Low-Rise Structural Steel Frames
ASTM A6	General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A36	Carbon Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A193	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low Temperature Service
ASTM F3125	Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength
ASTM A384	Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A992	Structural Steel Shapes
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate

Reference	Title
ASTM B241	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B308	Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM F436	Hardened Steel Washers
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AWS-B3.0	Welding Procedures and Performance Qualifications
AWS-D1.1	Structural Welding Code--Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.6	Structural Welding Code - Stainless Steel
ASW D1.8	Structural Welding Code – Seismic Supplement
FBC	Florida Building Code
AISC Steel Construction Manual	American Institute of Steel Construction, Manual of Steel Construction

1.03 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations 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 will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Shop drawings for approval prior to fabrication. Shop drawings shall not be reproductions of the Drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, coatings, connection details, blocks, copes, and cuts. Substitutions of details shown on the Drawings shall be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the Drawings.
5. Certification that steel fabricator is approved to perform steel fabrication without special inspection.
6. AISC quality certification: Evidence that steel fabricator has AISC 201 Certification as a “Standard Steel Building Structures” fabricator. Certificate to show name and address of certified firm, effective date, and category of certification.
7. Welding procedures, qualifications, and inspection report.
8. Certified mill test reports for structural steel and high-strength bolts and nuts.
9. In accordance with IBC Chapter 17, Fabricator at the completion of fabrication to

submit Certification of Compliance stating that the fabrication was performed in accordance with the design documents.

10. Certified copies of all surveys conducted by a registered professional engineer or surveyor showing elevations and locations of base plates and anchor bolts to receive structural steel or aluminum, and final elevations and locations for major members. Indicate discrepancies between actual installation and contract documents.

1.04 QUALITY ASSURANCE

A. Quality Control by Owner:

1. Special Inspection of structural metals work shall be performed by the Special Inspector under contract with the Owner and in conformance with the IBC Chapter 17. Special Inspector(s) and laboratory shall be acceptable to the Owner in their sole discretion. Special Inspection of structural metals is in addition to, but not replacing, other inspections and quality control requirements herein. Where sampling and testing required herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.
2. All structural steel work shall receive Special Inspection in accordance with IBC, Chapter 17. Structural steel includes all steel elements that resist code-defined loads and whose failure would affect life safety. Items to be inspected include, but are not limited to, mechanical/electrical supports, beams, stringers, columns, access walkways and stairways.

B. Fabricator Qualifications:

1. A qualified fabricator must participate in the AISC 201 Certification program and be designated an AISC Certified Plant, Category STD (Standard for Steel Building Structures).

PART 2 PRODUCTS MATERIALS

A. Steel:

1. Materials for structural metals shall be as specified in Table A.

Table A - Steel Materials

Material	Specification
Standard steel S-shapes, channels, angles and plates	ASTM A36
Standard rolled steel wide-flange sections and WTs	ASTM A992
Pipe sections for posts	ASTM A53, Type E or S, Grade B
Round Hollow Structural Sections (HSS)	ASTM A500, Grade B (Fy=42 ksi)
Square and Rectangular Hollow Structural Sections (HSS)	ASTM A500, Grade B (Fy = 46 ksi)
Stainless steel bolts (used at stainless steel and aluminum framing unless noted otherwise)	ASTM F593, Type 316
Stainless steel nuts and washers (used at stainless steel and aluminum framing unless noted otherwise)	ASTM F594, Type 316

Table A - Steel Materials

Material	Specification
Steel bolts (used at galvanized and painted steel framing)	Galvanized ASTM F3125 (Type 1), bearing type bolts fully tensioned
Carbon steel nuts and washers	Galvanized ASTM A563 nuts and galvanized ASTM F436 washers

B. Aluminum:

Table B - Aluminum Materials

Material	Specification
Aluminum structural shapes	Alloy 6061-T6 per ASTM B308
Bolts	Use stainless steel bolts for aluminum framing (see Table A above)
Aluminum guardrail and handrail pipe	Alloy 6061-T6 or 6063-T6 per ASTM B241
Aluminum plates	Alloy 6061-T6 per ASTM B209

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine and accept conditions before beginning work.

3.02 FABRICATION

A. Fabrication of steel shall be in accordance with the applicable provisions of the AISC Steel Construction Manual, [Latest Edition]. Fabrication of aluminum shall be in accordance with Aluminum Design Manual – Latest Edition. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under AISC 201 for Category STD (Standard for Steel Building Structures).

B. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro-inch and ends shall be square within the tolerances for milled ends specified in ASTM A6.

C. Shop splices of members will be permitted only where indicated on the Drawings. Splices not indicated require the approval of the Owner's Representative.

D. Verify measurements at the job site prior to fabrication. Fabricate to match job site measurements.

E. Provide holes as necessary or as indicated for securing other work to structural steel framing, and for passage of other work through steel framing members.

3.03 INSTALLATION

A. General:

1. Erection of structural steel shall be in accordance with the applicable provisions of AISC Steel Construction Manual. Erection plan shall conform to AISC 303. For low-rise structural steel buildings, 60 feet tall or less and a maximum of 2 stories, the structure shall be erected in accordance with AISC 810.
2. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in place work.
3. Employ a registered professional engineer or surveyor for accurate erection of the structural steel. Check elevations of concrete and locations of anchor bolts before erection proceeds and report discrepancies to the Owner's Representative.
4. Placement tolerances shall be in accordance with AISC 303.
5. After final positioning of steel members, provide full bearing under base plates and bearing plates using non-shrink grout. Place non-shrink grout in accordance with the manufacturer's instructions.
6. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings or isolators. Protect aluminum in contact with concrete or grout with a heavy coat of bituminous paint.
7. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned.
8. Structural steel completely encased in concrete shall not be galvanized or painted and shall have a clean surface for bonding to concrete.
9. Metalwork which is bent, broken or otherwise damaged shall be repaired or replaced.

B. Welding:

1. Welding shall be done by welders, welding operators, and tackers who have been qualified by tests as prescribed by AWS to perform the type of work required. The quality of welding shall conform to AWS Codes.
2. Develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures.
3. Provide continuous seal welds for plates or structural shapes that are exposed to or submerged in water or wastewater.

C. Bolted Connections:

1. Bolted connections, unless noted otherwise, shall conform to AISC 360 and shall be bearing type connections with bolts fully tensioned unless connecting HSS shapes. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Bolts, nuts, and washers shall be clean of dirt and rust and lubricated immediately prior to installation. No drifting of bolts or enlargement of holes will be allowed to correct misalignment. Holes shall not be cut or enlarged by burning. Mismatched holes shall be corrected with new material.

3.04 CORROSION PROTECTION

A. Unless otherwise specified, carbon steel shall be galvanized. If coatings are indicated on the Drawings or elsewhere in the Specifications, coat in accordance with Section 09900. Coating surface preparation shall be as specified in Section 09900 and shall include the following

operations:

1. Grind the exterior and interior edges of all flame-cut plates or members to a smooth surface.
2. Grind all sharp edges off of the sheared plates and punched holes.
3. Grind uneven or rough welds with high beads to a smooth finish.

3.05 CLEANING

A. After installation, damaged surfaces of shop primed metals shall be cleaned and touched up with the same material used for the shop coat. Damaged surfaces of galvanized metals shall be repaired as specified in Section 05910.

END OF SECTION

SECTION 05501 ANCHOR BOLTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Bolts and all-thread rods used to attach structural elements and equipment to concrete. Included are cast-in-place and post-installed anchors (adhesive systems and wedge type expansion anchors), nuts and washers.

B. Cast-in-place and post-installed anchors shall be Type 316 stainless steel unless noted otherwise.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 03300 Cast-In-Place Concrete
2. Section 11002 Rigid Equipment Mounts

1.03 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 318	Building Code Requirements for Structural Concrete
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A563	Carbon and Alloy Steel Nuts
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
ASTM F844	Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	Anchor Bolts, Steel, 36, 55, 105-ksi Yield Strength
IBC	International Building Code with local amendments
Florida State & Manatee County	Building Code with local amendments

1.04 SUBMITTALS

A. Action Submittals

1. Procedures: Section 01300.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations 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 will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Anchor bolt placement plans.
5. Anchor bolt, nut, and washer material information, including material certifications.
6. Record copy of design calculations and details showing the required diameter, length, embedment, edge distance, confinement, anchor reinforcement, anchor bolt sleeves, connection redesign, and other conditions, stamped and signed by a Professional Engineer currently registered in the state of FL. Calculations shall comply with the provisions of ACI 318-14, Chapter 17 ACI 318, Appendix D. Base anchor capacity determination on cracked concrete condition and compressive strength of new concrete per Section 03300. Assume compressive strength of existing concrete is 3,000 psi unless otherwise noted.
7. Submit record copy of proof loading test results within five days after test.
8. Product Data:
    a. ICC Evaluation Service Reports for post-installed adhesive type anchors and expansion (wedge type) anchors when allowed. Products shall be ICC approved for use in cracked concrete in high seismic areas (Seismic Design Category D, E and F).
    b. Product data indicating load capacity charts/calculations.
    c. Chemical resistance.
    d. Temperature limitations.
    e. Manufacturers written installation instructions.
9. Installer certification for horizontal or upwardly inclined adhesive anchors in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program.

1.05 QUALITY ASSURANCE

A. Quality Assurance By Owner

1. Special inspection of anchor bolts shall be performed by the Special Inspector under contract with the Owner and in accordance with IBC Chapter 17.
2. A five percent sample of installed post-installed anchors shall be proof-loaded by an independent laboratory contracted by the Contractor. The quantity of samples and locations shall be coordinated with the Owner's Representative.
3. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.

4. The Special Inspector shall furnish a report to the Engineer, Owner's Representative, and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).

B. Certifications

1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined adhesive anchors.

PART 2 PRODUCTS

2.01 GENERAL

A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 1/4 inch. Minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment mounting and vibration isolation systems shall be provided as specified in Division 11.

B. Tapered washers shall be provided where mating surface is not square with the nut.

C. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings. Substitution of post-installed anchors will not be permitted unless specifically requested by the Contractor and approved by the Engineer.

2.02 PERFORMANCE/DESIGN CRITERIA

A. Anchor bolts for equipment shall be designed by the equipment manufacturer to include equipment operational loads combined with seismic and wind forces when applicable. Design criteria provided in Section 01900.

B. Design anchor bolts for support and bracing of non-structural components and non-building structures for loading specified in Section 01900.

2.03 MATERIALS

A. Anchor bolt materials shall be as specified in the following table:

Material	Specification
Stainless Steel Anchor Bolts	ASTM A193 or A320, Type 316
Stainless Steel Threaded Rods	ASTM F593, Type 316
Stainless Steel Nuts	ASTM A194 Heavy Hex Nuts, Type 316 ASTM F594 Heavy Hex Nuts at Adhesive Anchors, Type 316
Stainless Steel Washers	Type 316 to match bolt material
Carbon Steel Anchor Bolts	ASTM F1554, Grade 36, Hot Dip Galvanized
High-Strength Carbon Steel Anchor Bolts	ASTM F1554, Grade 55, Weldable per Supplementary Requirement S1, Hot Dip Galvanized
Carbon Steel Nuts and Washers	ASTM A563 and F844, Heavy Hex, Hot-Dip Galvanized

Material	Specification
Concrete Adhesive Anchors	Hilti “HIT-RE 500v3”, Simpson Strong-Tie “SET-XP”, or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Adhesive Anchors	Hilti "HIT-HY 70", Simpson Strong-Tie “SET-XP”, or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Expansion (wedge) Anchors*	Hilti "KWIK BOLT 3", or approved equal, Type 316 Stainless Steel
Concrete Expansion (wedge) Anchors *	Hilti “KWIK BOLT TZ”, or approved equal, Type 316 Stainless Steel

**Post installed anchors shall always be an adhesive type anchor system except where noted otherwise or when Contractor makes a request for a specific application and Engineer approves.*

2.04 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)

A. Anti-seizing Lubricant for Stainless Steel Threaded Connections:
   1. Formulated to resist washout.
   2. Acceptable manufacturers are Bostik, Saf-T-Eze, or equal.

2.05 ANCHOR BOLT SLEEVES

A. Provide anchor bolt sleeves as shown on design drawings and as required by equipment manufacturer’s design.
   1. Provide high density polyethylene plastic sleeves of single unit construction with deformed sidewalls such that the concrete and grout lock in place.
   2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
   3. Acceptable manufacturers are Contec, Wilson, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings.

B. Grouting of anchor bolts using plastic sleeves with non-shrink or epoxy grout, where specified, shall be in accordance with Section 03300

C. The threaded end of anchor bolts and all-thread rods shall be long enough to project through the entire depth of the nut and if too long, shall be cut off at ½-inch beyond top of nut and ground smooth.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Anchor bolts to be embedded in concrete shall be placed accurately and held in correct position using templates while the concrete is placed.

B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

3.03 ADHESIVE ANCHOR BOLTS

A. Note that adhesive anchors shall not be substituted for cast-in-place anchor bolts unless the adhesive anchors have been specified or shown on the Drawings, or approval has been obtained from the Engineer that substitution of adhesive anchors is acceptable for the specific use and location. Use of adhesive anchors shall be subject to the following conditions:

1. Limit to locations where intermittent or continuous exposure to the following is extremely unlikely:
   a. Acid concentrations higher than 10 percent
   b. Chlorine gas
   c. Machine or diesel oils
2. Limit to applications where exposure to the following is extremely unlikely:
   a. Fire
   b. Concrete or rod temperature above 120 degrees F
3. Overhead applications (such as pipe supports) shall not be allowed unless approved by the Engineer and installation is by an Installer specially certified for overhead applications.
4. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
5. Anchor diameter and material shall be per Contract Documents or equipment manufacturer's specifications. Anchor shall be threaded or deformed the full length of embedment and shall be free of rust, scale, grease, and oils.
6. Embedment depth shall be as specified or as required by the equipment manufacturer.
7. Follow the anchor system manufacturer's installation instructions.
8. Holes shall have rough surfaces created by using a hammer drill with carbide bit. Core drilled holes are not allowed.
9. Holes shall be blown clean with oil-free compressed air and be free of dust or standing water prior to installation. Follow additional requirements of the adhesive manufacturer.
10. Concrete and air temperature shall be compatible with curing requirements of adhesives per adhesive manufacturer's instructions. Anchors shall not be placed in concrete when the temperature is below 25 degrees F.
11. Anchors shall be left undisturbed and unloaded for full adhesive curing period, which is based on temperature of the concrete.

3.04 EXPANSION ANCHORS

A. Expansion (wedge type) anchors shall not be substituted for cast-in-place anchor bolts or adhesive anchors unless approved by the Engineer for a specific application. Use of expansion anchors shall be subject to conditions 4 through 9 as specified above for adhesive anchors. Expansion anchors shall not be used in a submerged condition or in mounting of equipment subject to vibration or cyclic motion.

3.05 REINFORCING STEEL CONFLICTS WITH POST-INSTALLED ANCHOR INSTALLATION

A. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction and provide beveled washer to match angle of anchor. Drill shall not be slanted more than 10 degrees.

B. Where slanting the drill does not resolve the conflict, notify the Owner's Representative and resolve the conflict to the satisfaction of the Owner's Representative in consultation with the Engineer.

C. Abandoned post-installed anchor holes shall be cleaned and filled with non-shrink grout and struck off flush with adjacent surface.

D. The costs of determining and executing the resolution shall be borne by the Contractor. The determination and execution of the resolution shall not result in additional cost to the Owner.

E. Reinforcing steel in masonry shall not be damaged.

F. In order to avoid or resolve a conflict, locate embedded reinforcing steel using non-destructive methods and/or redesign the attachment.

1. Redesign shall be done by the Contractor's Professional Engineer currently registered in the state of FL.
2. Calculations and details for redesign shall be submitted.

END OF SECTION

SECTION 05 05 14 HOT-DIP GALVANIZING

PART 1 GENERAL

1.01 DESCRIPTION

A. Section includes: Hot-dip galvanizing of steel materials.

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 09 90 00 Painting and Coating

1.03 REFERENCES:

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A143	Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A384	Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
ASTM A385	Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM A780	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM B6	Zinc
ASTM D6386	Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM E536	Test Methods for Chemical Analysis of Zinc and Zinc Alloys
DOD-P-21035A	Paint, High Zinc Dust Content, Galvanizing Repair

1.04 SUBMITTALS

A. Action Submittals

1. Procedure: Section 01 33 00:
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations 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 will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Coating applicator's Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements of ASTM A123 or A153, as applicable.
5. Evidence that the galvanized coating applicator is a member of the American Galvanizing Association.

1.05 QUALITY ASSURANCE

A. Hot-dip galvanized coating applicator shall be a member of the American Galvanizing Association.

PART 2 PRODUCTS

2.01 MATERIALS

A. Zinc used for galvanizing shall conform to ASTM B6, and shall be at least equal to the grade designated as Prime Western.

B. Maximum amount of aluminum added to a galvanizing bath shall not exceed 0.01 percent.

C. Hot-Dip Galvanized Coating: Conform to ASTM A123 and A153, as applicable.

D. Repair: Zinc dust-zinc oxide coating conforming to DOD-P-21035A and containing 95 percent zinc in the dry film. Acceptable product is ZRC Cold Galvanizing Compound by ZRC Worldwide, or approved equal.

2.02 FABRICATION REQUIREMENTS

A. Fabrication practices for products to be galvanized: In accordance with applicable portions of ASTM A143, A384 and A385. Avoid fabrication techniques that could cause steel distortion or embrittlement.

B. Coordinate with steel detailer to provide vent and drain holes of sufficient size and quantity to achieve specified galvanized coating.

PART 3 EXECUTION

3.01 PREPARATION

A. Casting surfaces to be galvanized shall be sand blasted or ground smooth. When a smooth cast is required, castings shall be tumbled and all high spots ground flush. Castings shall be normalized to prevent cracking. Malleable iron shall be safeguarded against embrittlement by pre-annealing.

B. Steel work shall be precleaned utilizing a caustic bath, acid pickle and flux or shall be blast cleaned and fluxed to obtain an acceptable surface for quality hot dip galvanizing.

3.02 APPLICATION

A. Steel Members, Fabrications, and Assemblies: Hot-dip galvanize after fabrication in accordance with ASTM A123.

B. Steel Bolts, Screws, Nuts, Washers and Hardware Components: Hot-dip galvanize in accordance with ASTM A153.

3.03 COATING REQUIREMENTS

A. Hot-dip Coating Thickness: Conform to ASTM A123 or ASTM A153, as applicable.

3.04 TESTING

A. Chemical analysis for impurities in the bath shall be made in conformity with ASTM E536.

B. Test Requirements and Methods: In accordance with ASTM A123 or ASTMA153, as applicable.

3.05 GALVANIZED SURFACES TO BE PAINTED

A. Where galvanized surfaces are specified to be painted in Section 09 90 00 or elsewhere in the Project Manual, conform to ASTM D6386.

3.06 REPAIR OF DEFECTIVE GALVANIZED COATING

A. Where zinc coating has been damaged after installation, clean substrate surface and repair with zinc dust-zinc oxide coating in accordance with ASTM A780. Apply zinc dust-zinc oxide coating in accordance with manufacturer's recommendation. Apply multiple coats to achieve a minimum film thickness of 8 mils.

B. Remove items not physically damaged, but which have insufficient or deteriorating zinc coatings, and items damaged in shipment or prior to installation, from the project site for repair by the hot-dip zinc coating method.

END OF SECTION

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SECTION 07100 WATERPROOFING, DAMPPROOFING AND CAULKING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all materials, labor, equipment, and incidentals required to perform all through wall flashing work, waterproofing, dampproofing, caulking, and related work necessary for the proper completion of the project as required by the Drawings and as specified herein.

B. Dampproof the exterior surfaces of all exterior poured- in-place concrete walls or concrete masonry foundation walls from the top of the footings up to 6 inches below finished grade.

1.02 APPLICABLE SCHEDULE

A. Deliver all materials in original manufacturer's packages with labels and seals intact. Handle and store in accordance with manufacturer's instructions.

B. Inspect job conditions for defects which would prevent proper installation of caulking. Do not proceed until defects have been corrected.

C. Caulk all exterior wall joints between metal wall panels and adjacent materials, between frames in openings and adjacent materials, between masonry and cast-in-place concrete, brick paver expansion and control joints and all other joints shown on the Drawings or required for the completion of the Work.

D. Caulk all interior joints between frames and masonry, at tops of masonry walls, between masonry and structural concrete, expansion and control joints in ceramic tile and brick pavers, exterior window and door frames, louvers, and all other joints shown on the drawings or required for the completion of the Work.

E. Joints noted as "caulk", "caulking", or "sealant" shall be caulked with the sealant specified herein.

F. Furnish and place through wall flashing in exterior masonry walls as shown on the Drawings.

G. Furnish and place vapor barrier under all building structure slabs contacting soil as specified herein.

1.03 SUBMITTALS

Submit two representative samples of any or all other proposed materials and installation method required for the work of this Section as requested by the County.

PART 2 PRODUCTS

2.01 DAMPPROOFING

A. Dampproofing shall be Bitumastic Black Solution by the Koppers Company, Inc., Dehydrating 4 by W.R. Grace and Co., or equal.

2.02 CAULKING

A. Caulking Compound: One component, synthetic rubber base sealant, soft curing, nonstaining, conforming to F.S. TT-S-00230 and Thiocol's Building Trade Performance Specifications for Type 1 Class B sealants. Colors shall match material receiving caulking, as directed by the County.

B. Interior Silicone Sealant: F.S. TT-001543 for perimeter of plumbing fixtures against walls and floors and joints between laminated plastic counters and walls shall be transparent.

C. Primer: As recommended by caulking compound manufacturer.

D. Back-up Material: Closed cell foam polyethylene, or similar nonbituminous material as recommended by manufacturer of caulking compound and completely compatible with selected compound.

2.03 HYDRAULIC CEMENT

A. Material for quick-set hydraulic cement shall be Waterplug as manufactured by Thoro System Products, or equal.

2.04 VAPOR BARRIER

A. Vapor barrier shall be 10 mil thick polyethylene sheet with a vapor transmission rating of 0.20 perms. Laps between adjacent sheets shall be 10 inches minimum. Vapor barrier shall be carefully inspected by the County prior to concrete placement. Additional polyethylene sheet required for repair or replacement of damaged vapor barrier shall be furnished and installed by the Contractor as directed by the County at no additional cost to the County.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of Dampproofing

1. Surface to be treated shall be free from oil and dirt and shall be in the proper condition as indicated by the manufacturer prior to the application of the dampproofing material. The concrete shall have been completely cured and the surface shall be dry and free from frost at the time of application.
2. Surfaces to be dampproofed shall receive two (2) heavy coats 10 mils thick, the first coat being carefully applied so that "holidays" or untreated air-bubble depressions in the surface shall be completely filled and the second coat will guarantee a 100% coating of the surface.
3. Particular care shall be given to the application of dampproofing at all construction joints which are encountered.
4. The number of coats specified is in addition to primer coats as recommended by the manufacturer.

B. Installation of Caulking

1. Surface Preparation: Clean metal surfaces free of grease, oil, wax, lacquer, and other foreign residue by wiping with a clean cloth moistened with a suitable solvent. Scrape or brush masonry surfaces clean. Apply appropriate primer to contact surfaces.
2. Joint Preparation: Joints to be caulked having a depth in excess of 3/8-inch shall be packed with back-up material. Round back-up material shall be sized to require 20

percent to 5 percent compression upon insertion. In joints not of sufficient depth to allow packing, install polyethylene bond-breaking tape at back of joint. Avoid lengthwise stretching of back-up material. Cut all corners, avoid wrapping around corners.

3. Application: Apply compound with pressure flow gun with nozzle of proper size and shape to suit width of joint, promptly after mixing and with sufficient pressure to fill joint. Apply as a continuous operation horizontally in one direction and vertically from bottom to top, except joints having excessive widths where compound might sag, the joints shall be built up with excessive beads. Finish joints smooth and slightly covered.
4. Cleaning: Immediately clean adjacent material which may be soiled by caulking operation.

C. Installation of Quick-Set Hydraulic Cement

1. The surface shall be cleaned and free of dirt, loose mortar particles, paints, films, protective coatings, efflorescence, laitance, form treatments, curing compounds, and other materials.
2. Cut out crack at least 3/4 inches wide and deep, cutting back into wall slightly. Flush away all cuttings and dirt. Force water-plug into prepared crack with a round tool and smooth out. Form cove at junction.
3. To be applied under manufacturer's recommendations.

END OF SECTION

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SECTION 09865 SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified herein.

1.02 SUBMITTALS

A. Submit to the County for approval, as provided in the Contract Drawings for shop drawings, manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thickness.

B. Submit representative physical samples of the proposed primers, if required by the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Submerged Services: Shop primer for ferrous metals which will be subject to splash action or which are specified to be considered submerged service shall be sprayed with one coat of Koppers 654 epoxy Primer or Koppers Inertol Primer 621-FDA, dry film thickness 3.5 to 4.5 mils by Koppers Co., Inc., or equal.

B. Nonsubmerged Services: Shop primer for ferrous metals other than those covered by paragraph 2.01 A shall be sprayed with one coat of Koppers Pug Primer, dry film thickness 3.0 to 4.0 mils by Koppers Co., Inc. or equal.

C. Nonprimed Surfaces: Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the County up to the time of the final acceptance.

D. Compatibility of Coating Systems: Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in the Contract Documents for use in the field and which are recommended for use together.

PART 3 EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming:

1. Non submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-10. Near White, immediately prior to priming.

2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale and other foreign material before priming.
3. Shop prime in accordance with approved paint manufacturer's recommendations.
4. Priming shall follow sandblasting before any evidence of corrosion has occurred and within 24 hours.

END OF SECTION

SECTION 09900 PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, tools, materials, equipment, scaffolding or other structures and incidentals necessary to complete this Contract in its entirety.

B. The work includes painting and finishing of all new interior and exterior exposed items above and below grade and surfaces, such as structural steel, miscellaneous metals, ceilings, walls, floors, doors, frames, transoms, roof fans, construction signs, guardrails, posts, fittings, valves, tanks, equipment and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the Schedule of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

C. The following items shall not be painted:

1. Any code-requiring labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
2. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.
3. Aluminum handrails (except where in contact with concrete) walkways, windows, louvers and grating unless otherwise specified herein.
4. Signs and nameplates.
5. Finish hardware.
6. Chain link fence.
7. Piping buried in the ground or embedded in concrete.
8. Concealed surfaces of pipe or crawl space.
9. Nonferrous metals, unless specifically noted otherwise.
10. Electrical switchgear and motor control centers.
11. Stainless steel angles, tubes, pipe, etc.
12. Products with polished chrome, aluminum, nickel or stainless steel finish.
13. Plastic switch plates and receptacle plates.
14. Flexible couplings, lubricated bearing surfaces, insulation and metal and plastic pipe interior.
15. Sprinkler heads.
16. Lifting chain on cranes and hoists
17. Electrical cable, festooned conductor system, cables, collector pole brackets, etc.

D. All work shall be done in strict accordance with this Specification, the Design Drawings and the painting package, including manufacturer's printed instructions.

E. The Contractor will obtain, at its own expense, all permits, licenses and inspections and shall comply with all laws, codes, ordinances, rules and regulations promulgated by authorities having jurisdiction which may bear on the Work. This compliance will include Federal Public Law 91-596 more commonly known as the "Occupational Safety and Health Act of 1970".

1.02 DEFINITIONS

A. Field Painting is the painting of new or rebuilt items at the job site. Field painting shall be the responsibility of the Contractor.

B. Shop Painting is the painting of new or rebuilt items in the shop prior to delivery to the jobsite.

C. Abbreviations The abbreviations and definitions listed below, when used in this specification, shall have the following meanings:

1. SSPC - Steel Structures Painting Council
2. Exterior - Outside, exposed to weather
3. Interior Dry - Inside, concealed or protected from weather
4. Interior Wet - Inside, subject to immersion services
5. ASTM - American Society of Test Materials
6. NACE - National Association of Corrosion Engineers
7. NSF - National Sanitation Foundation
8. AWWA - American Water Works Association

D. Dry Film Thickness shall be in Mils.

1.03 RESOLUTION OF CONFLICTS

A. It shall be the responsibility of the Contractor to arrange a meeting prior to the start of painting, or flooring installation between the Contractor, the Paint Manufacturer, whose products are to be used, and the County. All aspects of surface preparation, application and coating systems as covered by this Specification will be reviewed at this meeting.

B. Clarification shall be requested promptly from the County when instructions are lacking, conflicts occur in the Specifications, or the procedure seems improper or inappropriate for any reason.

C. Copies of all manufacturer's instructions and recommendations shall be furnished to the County by the Painting Contractor.

D. It shall be the responsibility of the Coating Manufacturer to have their factory representative meet in person with the Contractor and County a minimum of three times during the job as a consultant on surface preparation, mil thickness of coating and proper application of coating unless meeting is determined to be unnecessary by the County.

1.04 SUBMITTALS

A. Contractor shall submit catalog data and cut sheets for the painting system being used if not the TNEMEC materials specified.

B. Samples as detailed in 3.01 B shall be submitted regardless of system being used, showing each color to be used.

C. Hazardous Material Disposal documentation shall be submitted if applicable.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Effective oil and water separators shall be used in all compressed air lines serving spray painting and sandblasting operations to remove oil or moisture from the air before it is used. Separators shall be placed as far as practicable from the compressor.

B. All equipment for application of the paint and the completion of the work shall be furnished by the Contractor in first-class condition and shall comply with recommendations of the paint manufacturer.

C. Contractor will provide free of charge to the County a "Nordson-Mikrotest" or "Positest" dry film thickness gauge for ferrous metal and an OG232 "Tooke" gauge or equal for non-ferrous and cementitious surface, to be used to inspect coatings by the County and Contractor. The gauges may be used by the Contractor and returned each day to the County. County will return gauges to Contractor at completion of job.

2.02 MATERIALS

A. All materials specified herein are manufactured by the TNEMEC Company, Inc., North Kansas City, Missouri. These products are specified to establish standards of quality and are approved for use on this Project.

B. Equivalent materials of other manufacturers may be substituted on approval of the County. Requests for substitution shall include manufacturer's literature for each product giving the name, generic type, descriptive information and evidence of satisfactory past performance and an independent laboratory certification that their product meets the performance criteria of the specified materials.

C. Abrasion - Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 1,000 grams load.

D. Adhesion - Elcometer Adhesion Tester.

E. Exterior Exposure - Exposed at 45 degrees facing the ocean (South Florida Marine Exposure)

F. Hardness - ASTM D3363-74

G. Humidity - ASTM D2247-68

H. Salt Spray (Fog) - ASTM B117-73

I. Standard practice for Operating the Severe Wastewater Analysis Testing Apparatus ASTM G210-13

I. Substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved. Prime and finish coats of all surfaces shall be furnished by the same manufacturer.

J. All coatings to be shop applied must meet the requirements for volatile organic compounds (VOC) of not more than 3.5 lbs/gallon after thinning.

K. Colors, where not specified, shall be as selected by the County or their Representative.

L. All coatings in contact with potable water need to be NSF Certified in accordance with ANSI/NSF Standard 61.

M. All above ground potable water mains and appurtenances shall be painted safety blue.

PART 3 EXECUTION

3.01 INSPECTION OF SURFACES

A. Before application of the prime coat and each succeeding coat, all surfaces to be coated shall be subject to inspection by the County. Any defects or deficiencies shall be corrected by the Contractor before application of any subsequent coating.

B. Samples of surface preparation and of painting systems shall be furnished by the Contractor to be used as a standard throughout the job, unless omitted by the County.

C. When any appreciable time has elapsed between coatings, previously coated areas shall be carefully inspected by the County, and where, in his opinion, surfaces are damaged or contaminated, they shall be cleaned and recoated at the Contractor's expense. Recoating times of manufacturer's printed instructions shall be adhered to.

D. Coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" "Positest" Coating Thickness Gauge (or equal) for ferrous metal or an OG232 "Tooke" Paint Inspection gauge (or equal) for non-ferrous and cementitious surfaces. Please note that use of the "Tooke" gauge is classified as a destructive test.

3.02 SURFACE PREPARATION

The surface shall be cleaned as specified for the paint system being used. All cleaning shall be as outlined in the Society for Protective Coatings (SSPC) Surface Preparation Specification, And the International Concrete Repair Institute (ICRI) unless otherwise noted. If surfaces are subject to contamination, other than mill scale or normal atmospheric rusting, the surfaces shall be pressure washed, and acid or caustic pH residues neutralized, in addition to the specified surface preparation.

3.03 STANDARDS FOR SURFACE PREPARATION

A. Chemical and/or Solvent Cleaning: Remove all grease, oil, salt, acid, alkali, dirt, dust, wax, fat, foreign matter and contaminates, etc. by one of the following methods: steam cleaning, alkaline cleaning, or volatile solvent cleaning.

B. Hand Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to a clean sound substrate by hand chipping, scraping, sanding and wire brushing.

C. Power Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to a clean sound substrate by power tool chipping, descaling, sanding, wire brushing and grinding.

D. Flame Cleaning: Dehydrating and removal of rust, loose mill scale and some light mill scale by use of flame, followed by wire brushing.

E. White Metal Blast Cleaning: Complete removal of all mill scale, rust, rust scale, previous

coating, etc., leaving the surface a uniform gray-white color.

F. Commercial Grade Blast Cleaning: Complete removal of all dirt, rust scale, mill scale, foreign matter and previous coating, etc., leaving only shadows and/or streaks caused by rust stain and mill scale oxides. At least 66% of each square inch of surface area is to be free of all visible residues, except slight discoloration.

G. Brush-Off Blast Cleaning: Removal of rust scale, loose mill scale, loose rust and loose coatings, leaving tightly-bonded mill scale, rust and previous coatings. On concrete surfaces, brush-off blast cleaning shall remove all laitance, form oils and solid contaminates. Blasting should be performed sufficiently close to the surface so as to open up surface voids, bugholes, air pockets and other subsurface irregularities, but so as not to expose underlying aggregate.

H. Pickling: Complete removal of rust and mill scale by acid pickling, duplex pickling or electrolytic pickling (may reduce the resistance of the surface to corrosion, if not to be primed immediately).

I. Near-White Blast Cleaning: Removal of all rust scale, mill scale, previous coating, etc., leaving only light stains from rust, mill scale and small specks of previous coating. At least 95% of each square inch of surface area is to be free of all visible residues and the remainder shall be limited to slight discoloration.

J. Power Tool Cleaning to Bare Metal: Complete removal of rust, rust scale, mill scale, foreign matter and previous coatings, etc., to a standard as specified on a Commercial Grade Blast Cleaning (SSPC-SP-6, NACE-3) by means of power tools that will provide the proper degree of cleaning and surface profile.

K. Surface Preparation of Concrete (SSPC-SP13)

L. Visual standards "Pictorial Surface Preparation Standards for Painting Steel Surfaces", and the National Association of Corrosion Engineer, "Blasting Cleaning Visual Standards" TM-01-70 and TM-01-75 shall be considered as standards for proper surface preparation.

M. Oil, grease, soil, dust, etc., deposited on the surface preparation that has been completed shall be removed prior to painting according to Solvent Cleaning under this Specification.

N. Weld flux, weld spatter and excessive rust scale shall be removed by Power Tool Cleaning as per these Specifications.

O. All weld seams, sharp protrusions and edges shall be ground smooth prior to surface preparation or application of any coatings.

P. All areas requiring field welding shall be masked off prior to shop coating, unless waived by the County.

Q. All areas which require field touch-up after erection, such as welds, burnbacks, and mechanically damaged areas, shall be cleaned by thorough Power Tool as specified in these Specifications.

R. Touch-up systems will be same as original specification except that approved manufacturer's organic zinc-rich shall be used in lieu of inorganic zinc where this system was originally used. Also strict adherence to manufacturer's complete touch-up

recommendations shall be followed. Any questions relative to compatibility of products shall be brought to the County's attention; otherwise, Contractor assumes full responsibility.

3.03 PRETREATMENTS

When specified, the surface shall be pretreated in accordance with the specified pretreatment prior to application of the prime coat of paint.

3.04 STORAGE

Materials shall be delivered to the job site in the original packages with seals unbroken and with legible unmutilated labels attached. Packages shall not be opened until they are inspected by the County and required for use. All painting materials shall be stored in a clean, dry, well-ventilated place, protected from sparks, flame, direct rays of the sun or from excessive heat. Paint susceptible to damage from low temperatures shall be kept in a heated storage space when necessary. The Contractor shall be solely responsible for the protection of the materials stored by himself at the job site. Empty coating cans shall be required to be neatly stacked in an area designated by the County and removed from the job site on a schedule determined by the County. County may request a notarized statement from Contractor detailing all materials used on the Project.

3.05 PREPARATION OF MATERIALS

A. Mechanical mixers, capable of thoroughly mixing the pigment and vehicle together, shall mix the paint prior to use where required by manufacturer's instructions; thorough hand mixing will be allowed for small amounts up to one gallon. Pressure pots shall be equipped with mechanical mixers to keep the pigment in suspension, when required by manufacturer's instructions. Otherwise, intermittent hand mixing shall be done to assure that no separation occurs. All mixing shall be done in accordance with SSPC Vol. 1, Chapter 4, "Practical Aspects, Use and Application of Paints" and/or with manufacturer's recommendations.

B. Catalysts or thinners shall be as recommended by the manufacturer and shall be added or discarded strictly in accordance with the manufacturer's instruction.

3.06 APPLICATION

A. Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather, unless otherwise allowed by the paint manufacturer. Except as provided below, painting shall not be permitted when the atmospheric temperature is below 50 deg F, or when freshly painted surfaces may be damaged by rain, fog, dust, or condensation, and/or when it can be anticipated that these conditions will prevail during the drying period.

B. No coatings shall be applied unless surface temperature is a minimum of 5 Degrees above dew point; temperature must be maintained during curing.

C. See coating schedule for actual coating systems to be used on this project.

3.07 DEW POINT CALCULATION CHART

DEW POINT CALCULATION CHART

Ambient Air Temperature - Fahrenheit

Relative Humidity	20	30	40	50	60	70	80	90	100	110	120
90%	18	28	37	47	57	67	77	87	97	107	117
85%	17	26	36	45	55	65	76	84	95	104	113
80%	16	25	34	44	54	63	73	82	93	102	110
75%	15	24	33	42	52	62	71	80	91	100	108
70%	13	22	31	40	50	60	68	78	88	96	105
65%	12	20	29	38	47	57	66	76	85	93	103
60%	11	29	27	36	45	55	64	73	83	92	101
55%	9	17	25	34	43	53	61	70	80	89	98
50%	6	15	23	31	40	50	59	67	77	86	94
45%	4	13	21	29	37	47	56	64	73	82	91
40%	1	11	18	26	35	43	52	61	69	78	87
35%	-2	8	16	23	31	40	48	57	65	74	83

SURFACE TEMPERATURE AT WHICH CONDENSATION OCCURS

Dew Point

Temperature at which moisture will condense on surface. No coatings should be applied unless surface temperature is a minimum of 5deg above this point. Temperature must be maintained during curing.

Example

If air temperature is 70 deg F and relative humidity is 65%, the dew point is 57 deg F. No coating should be applied unless surface temperature is 62 deg F minimum.

A. No coating shall be applied unless the relative humidity is below 85%.

B. Suitable enclosures to permit painting during inclement weather may be used if provisions are made to control atmospheric conditions artificially inside the enclosure, within limits suitable for painting throughout the painting operations.

C. Field painting in the immediate vicinity of, or on, energized electrical and rotating equipment, and equipment and/or pipes in service shall not be performed without the approval of the County.

D. Extreme care shall be exercised in the painting of all operable equipment, such as valves, electric motors, etc., so that the proper functioning of the equipment will not be affected.

E. The Contractor's scaffolding shall be erected, maintained and dismantled without damage

to structures, machinery, equipment or pipe. Drop cloths shall be used where required to protect buildings and equipment. All surfaces required to be clear for visual observation shall be cleaned immediately after paint application.

F. Painting shall not be performed on insulated pipe within three (3) feet of insulation operations or on insulation whose covering and surface coat have not had time to set and dry. Painting shall not be performed on uninsulated pipe within one (1) foot of any type of connection until the connection has been made, except as directed by the County.

G. The prime coat shall be applied immediately following surface preparation and in no case later than the same working day. All paint shall be applied by brushing, paint mitt and roller, conventional spraying, or airless spraying, using equipment approved by the paint manufacturer.

H. Each coat of paint shall be recoated as per manufacturer's instructions. Paint shall be considered recoatable when an additional coat can be applied without any detrimental film irregularities such as lifting or loss of adhesion.

I. Surfaces that will be inaccessible after assembly shall receive either the full specified paint system or three shop coats of the specified primer before assembly.

J. Finish colors shall be in accordance with the COLOR SCHEDULE and shall be factory mixed (i.e., there shall be no tinting by the Contractor, unless authorized by the County).

K. All edges and weld seams in immersion service shall receive a "stripe coat" (applied by brush) of the 2nd coat prior to application of the full 2nd coat.

L. All open seams in the roof area of tanks shall be filled after application of the topcoat with a flexible caulking such as Sika Flex 1A.

3.08 WORKMANSHIP

A. The Contractor must show proof that all employees associated with this Project shall have been employed by the Contractor for a period not less than six (6) months.

B. Painting shall be performed by experienced painters in accordance with the recommendations of the paint manufacturer. All paint shall be uniformly applied without sags, runs, spots, or other blemishes. Work which shows carelessness, lack of skill, or is defective in the opinion of the County, shall be corrected at the expense of the Contractor.

C. The Contractor shall provide the names of at least three other projects of similar size and scope that they have successfully completed under their current company name.

3.09 APPLICATION OF PAINT

A. By Brush and/or Rollers

1. Top quality, properly styled brushes and rollers shall be used. Rollers with a baked phenol core shall be utilized.
2. The brushing or rolling shall be done so that a smooth coat as nearly uniform in thickness as possible is obtained. Brush or roller strokes shall be made to smooth the film without leaving deep or detrimental marks.
3. Surfaces not accessible to brushes or rollers may be painted by spray, by dauber or

sheepskins, and paint mitt.

4. It may require two coats to achieve the specified dry film thickness if application is by brush and roller.

B. Air, Airless or Hot Spray

1. The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied and shall be equipped with suitable pressure regulators and gauges.
2. Paint shall be applied in a uniform layer, with a 50% overlap pattern. All runs and sags should be brushed out immediately or the paint shall be removed and the surface resprayed.
3. High build coatings should be applied by a cross-hatch method of spray application to ensure proper film thickness of the coating.
4. Areas inaccessible to spray shall be brushed; if also inaccessible to brush, daubs or sheepskins shall be used, as authorized by the manufacturer.
5. Special care shall be taken with thinners and paint temperatures so that paint of the correct formula reaches the receiving surface.
6. Nozzles, tips, etc., shall be of sizes and designs as recommended by the manufacturer of the paint being sprayed.
7. The first coat on concrete surfaces in immersion service should be sprayed and back rolled.

3.10 PROTECTION AND CLEANUP

A. It shall be the responsibility of the Contractor to protect at all times, in areas where painting is being done, floors, materials of other crafts, equipment, vehicles, fixtures, and finished surfaces adjacent to paint work. Cover all electric plates, surface hardware, nameplates, gauge glasses, etc., before start of painting work.

B. At the option of the County during the course of this project, the Contractor will contain all spent abrasives, old paint chips, paint overspray and debris by means suitable to the County, including, but not limited to, full shrouding of the area.

C. If shrouding is required, the Contractor must provide a complete design of the intended shroud or cover. Care must be taken not to modify or damage the structure during the use of the shroud. If damage should occur, the Contractor is held responsible for all repairs.

D. At completion of the work, remove all paint where spilled, splashed, spattered, sprayed or smeared on all surfaces, including glass, light fixtures, hardware, equipment, painted and unpainted surfaces.

E. After completion of all painting, the Contractor shall remove from job site all painting equipment, surplus materials and debris resulting from this work.

F. The Contractor is responsible for the removal and proper disposal of all hazardous materials from the job site in accordance with Local, State and Federal requirements as outlined by the Environmental Protection Agency.

G. A notarized statement shall be presented to the County that all hazardous materials have been disposed of properly including, but not limited to: name of disposal company, disposal site, listing of hazardous materials, weights of all materials, cost per pound and EPA registration number.

3.11 TOUCH-UP MATERIALS

The Contractor shall provide at the end of the Project at least one (1) gallon of each generic topcoat in each color as specified by the County for future touch-up. Two gallons may by required for (2) component materials.

3.12 ON-SITE INSPECTION

During the course of this Project, the County will reserve the option of incorporating the services of a NACE Level III inspection service. The inspection service will be responsible for assuring the proper execution of this Specification by the successful Contractor.

3.13 STEEL - STRUCTURAL, TANKS, PIPES AND EQUIPMENT

A. EXTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 1095-1: Epoxy/High Build Urethane

This system is highly resistant to abrasion, wet conditions, corrosive fumes and chemical contact. Provides 3-4 times the color and gloss retention of conventional paints. Second coat to be close to finish color but not the same color. This system should be used for above ground exterior steel surfaces that are neither submerged, nor buried.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 66HS-1211 Epoxoline Primer	3.0 - 4.0	
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 3.0	
3rd Coat: 1095-Endura-Shield III	2.0 - 3.0	
	Dry Film Thickness	7.0 - 10.0
	Minimum	8.0 Mils

2. System No. 1095-2: High Build Urethane for Marginally Cleaned Surfaces or Topcoating Existing System

This system can be used over factory finish paint or cover non-sandblasted steel and offer the high performance of a urethane coating. Specify Series 1074U Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning or SSPC-SP3 Power Tool Cleaning

Shop Coat: Manufacturer Standard Primer (or existing coating)	3.0-5.0	
2nd Coat: 135 Chembuild	3.0 - 5.0	
3rd Coat: 1095-Color Endura-Shield	2.0 - 3.0	
	Dry Film Thickness	8.0 - 13.0
	Minimum	9.5 Mils

4. System 90-97: Zinc/Epoxy/Urethane

This system offers the added corrosion protection of a zinc rich primer. Series 90-97 Tneme-Zinc is an organic zinc-rich primer that can be used for field touch up of a zinc primer or for touch up of galvanized surfaces that are damaged.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 90-97 Tneme-Zinc	2.5 - 3.5	
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 3.0	
3rd Coat: 1095 Endurashield	2.0 - 3.0	
	Dry Film Thickness	6.5 - 9.5
	Minimum	8.0 Mils

B. INTERIOR EXPOSURE (NON-IMMERSION)

1. System No.66HS-1: High Build Epoxy

This system will provide chemical and corrosion resistance against abrasion, moisture, corrosion fumes, chemical contact and immersion in non-potable water. Primer coat must be touched-up before second coat is applied. Substitute Series 161HS for low temperature cure or quick recoats. Use this system for interior exposed, non submerged metals.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 66HS-1211 Epoxoline Primer	3.0 - 5.0	
2nd Coat: 66HS-Color Hi-Build Epoxoline	4.0 - 6.0	
	Dry Film Thickness	7.0 - 11.0
	Minimum	9.0 Mils

2. System No. 66HS-2: High Build Epoxy (Over OEM Finishes)

This system is to be used over standard manufacturer's primer to offer a high performance epoxy finish. Excellent for areas of rust not able to be completely cleaned.

Surface Preparation: Spot SSPC-SP6 Commercial Blast Cleaning or SSPC- SP11 Power Tool Cleaning to Bare Metal

Shop Coat: Manufacturer's Standard (or existing coating)	1.0 - 2.0	
2nd Coat: 27WB	2.5 - 4.0	
3rd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0	
	Dry Film Thickness	5.5 - 10.0
	Minimum	7.0 Mils

C. IMMERSION

1. System No. 104-1: High Solids Epoxy (Non-Potable Water)

This system will provide chemical and corrosion resistance for protection against abrasion, moisture, corrosive fumes, chemical contact and immersion in ***mild to moderate*** Wastewater, such as clarifiers, chlorine contact basins, aeration basins,

settling basins and other open top (aerobic) structures. Primer coat must be touched-up before second coat is applied. Scarify the surface before topcoating if the Series 66HS has been exterior-exposed for 60 days or longer. Substitute Series 161HS for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat: 66HS-1211 Epoxoline Primer	3.0 - 5.0	
2nd Coat: 104-Color Hi-Build Epoxoline	6.0-8.0	
3rd Coat: 104-Color Hi-Build Epoxoline	6.0-8.0	
	Dry Film Thickness	15.0 - 21.0
	Minimum	11.0 Mils

2. System No. 20HS-1: Epoxy-Polyamide (Potable Water)

This system meets American Water Works Association AWWA D 102 Inside Paint System Number 1. Series 20HS meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61. Substitute Series FC20HS for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat:20HS-WH02 Pota-Pox (Tank White)	3.0 - 5.0	
2nd Coat: 20HS-1255 Pota-Pox (Beige)	4.0 - 6.0	
3rd Coat: 20HS-WH02 Pota-Pox (Tank White)	4.0 - 6.0	
	Dry Film Thickness	11.0 - 17.0
	Minimum	12.0 Mils

3.14 OVERHEAD METAL DECKING, JOIST

A. INTERIOR EXPOSURE

System No. 115-1: Uni-Bond

This system should be used on ceiling areas where a one-coat system is desired. Can be applied over steel, galvanized and aluminum decking, joist, shop primed beams, conduits and concrete.

Surface Preparation: Surfaces must be dry, clean and free of oil, grease and other contaminates. Allow concrete to cure 28 days.

Coating: 115-Color Uni-Bond Dry Film Thickness 2.5 - 4.0

B. EXTERIOR EXPOSURE

System No. 1029-1: Enduratone

This system can be applied over a wide variety of coatings and factory finishes. It can also be applied direct to galvanized aluminum decking, joists, & conduits

Surface Preparation: Pressure clean to remove all dirt, oil, grease, chemicals and foreign contaminates. Remove loose paint and all rust by hand and power tool cleaning (SSPC-SP 2 & 3)

1st Coat:	1029-Color Endura-tone	2.0-3.0
2nd Coat:	1029-Color Enduratone	2.0-3.0
		Dry Film Thickness 4.0-6.0

3.16 GALVANIZED STEEL - PIPE AND MISCELLANEOUS FABRICATIONS

A. EXTERIOR / (NON-IMMERSION)

System No. 1095-3: Epoxy/High Build Urethane

Series 66HS has excellent adhesion to galvanized steel. This system is highly resistant to abrasion, wet conditions, corrosive fumes and chemical contact. Provides 3-4 times the color and gloss retention of conventional paints. First coat to be same color as or close to the finish color. Specify Series 1074U Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP1 Solvent Cleaning, followed by Sweep Abrasive Blasting (SSPC-SP7)

1st Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0	
2nd Coat: 1095-Color Endura-Shield	2.0 - 4.0	
	Dry Film Thickness	4.0 - 8.0
	Minimum	5.0 Mils

B. INTERIOR EXPOSURE (NON IMMERSION) AND ALUMINUM IN CONTACT WITH CONCRETE

System No. 66HS-3: Polyamide Epoxy

Surface Preparation: SSPC-SP1 Solvent Cleaning

1st Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0	
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 4.0	
	Dry Film Thickness	4.0 - 8.0
	Minimum	5.0 Mils

3.18 CONCRETE (Except for Wetwell – For Wetwell See Contract Drawings)

A. EXTERIOR - ABOVE GRADE

1. System No. 1026-1: Acrylic Emulsion Low Sheen

If semi-gloss finish is desired, use Series 1029 Tneme-Cryl SG as the second coat.

Surface Preparation: Allow new concrete to cure for 28 days. Surface must be clean and dry.

1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0	
2nd Coat:1026-Color Tneme-Cryl	2.0 - 3.0	
	Dry Film Thickness	4.0 - 6.0
	Minimum	5.0 Mils

2. System No. 156-1: Modified Acrylic Elastomer

If texture is needed, use 157 Enviro-Crete TX (medium texture) For application over previously applied coatings, use TNEMEC Series 151 Elasto-Grip at 1.0 - 2.5 mils DFT prior to the application of Series 156 Enviro-Crete.

Surface Preparation: Surface must be clean and dry.

1st Coat: 156-Color Enviro-Crete	4.0 - 8.0
2nd Coat: 156-Color Enviro-Crete	4.0 - 8.0
Dry Film Thickness	8.0 - 16.0
Minimum	10.0 Mils

B. EXTERIOR - BELOW GRADE

1. System No. 46-31: Coal Tar-Epoxy

Surface Preparation: Surface shall be clean and dry.

One Coat: 46H-413 Hi-Build Tneme-Tar

Dry Film Thickness	14.0 - 20.0

C. EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 1026-2: Acrylic Emulsion, Low Sheen (Interior/Exterior)

This system will provide a decorative coating with good exterior durability, color retention, and a high vapor transmission rate. ***For Semi-Gloss finish, use 1029-Color Tneme-Cryl S/G.***

Surface Preparation: Surface shall be clean and dry. Allow concrete to cure for 28 days.

Block Filler (CMU only): 1254 Epoxoblock	125 SF/GL
1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat:1026-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

*Does not include Block Filler

2. System No. 66HS-4: Epoxy-Polyamide (Interior)

Series 66HS provides excellent protection from abrasion, moisture, corrosive fumes and chemical contact..

Surface Preparation: Surfaces shall be clean and dry. Allow concrete to cure for 28 days. All surfaces must be clean and dry.

Block Filler (CMU only): 1254 Epoxoblock	125 SF/GL
1st Coat: 66HS-Color Hi-Build Epoxoline	3.0 - 5.0
2nd Coat: 66HS-Color Hi-Build Epoxoline	4.0 - 6.0
Dry Film Thickness	7.0 -11.0*
Minimum	9.0 Mils

*(Does not include Block Filler)

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D. IMMERSION - POTABLE & NON-POTABLE WATER

1. System No. 104-2: High Solids Epoxy (Non-Potable Water). This system will provide chemical and corrosion resistance for protection against abrasion, moisture, corrosive fumes, chemical contact and immersion in *mild to moderate* Wastewater, such as clarifiers, chlorine contact basins, aeration basins, settling basins and other open top (aerobic) structures.

   Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

   Apply Tnemec Series 218 to all surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, mitigate concrete outgassing, and to create a monolithic, paintable surface.

1st Coat: 104-1255 H.S. Epoxy Primer	6.0 - 8.0	
2nd Coat: 104 Color H.S. Epoxy	6.0 - 8.0	
3rd Coat: 104 Color H.S. Epoxy	6.0-8.0	
	Dry Film Thickness	18.0 - 240.0
	Minimum	20.0 Mils

2. System No. 20HS-2 Epoxy-Polyamide (Potable Water)

   This system meets American Water Works Association AWWA D 102 Inside System No. 1. Series 20HS meets the requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61.

   Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

   Apply Tnemec Series 218 to all surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, and to create a monolithic, paintable surface.

1st Coat: 20HS-15BL Pota-Pox	4.0 - 6.0	
2nd Coat: 20HS-1255 Pota-Pox Finish	4.0 - 6.0	
3rd Coat: 20HS -15BL	4.0-6.0	
	Dry Film Thickness	12.0 - 17.0
	Minimum	13.0 Mils

E. INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 66HS-5: High Solids Epoxy

   This system will produce a slick, tile-like finish that has excellent chemical and water resistance. Surface will be easy to clean.

Surface Preparation: Allow new concrete to cure for at least 28 days. Surface to be clean and dry.

1st Coat: 66HS-Color H.S. Epoxy	6.0 - 8.0
2nd Coat: 66HS-Color H.S. Epoxy	6.0 - 8.0
Dry Film Thickness	12.0 - 16.0
Minimum	14.0 Mils

2. System No. 113-1: Acrylic-Epoxy Semi-Gloss

This system will provide high performance and can be applied directly over existing coatings without lifting. Can be used when low odor is required during application. Specify Series 114 Tneme-Tufcoat for Gloss Finish.

Surface Preparation: Allow new concrete to cure for at least 28 days. Surface must be clean and dry.

One or Two Coats: 113-Color Tneme-Tufcoat

Dry Film Thickness	4.0 - 6.0

3.19 CONCRETE FLOORS

A. EPOXY FLOOR COATINGS

1. System No. 290-1: Epoxy- Chemical Resistant Urethane

This system will provide a durable, long-wearing coating that bonds tightly to concrete and stands up under heavy foot traffic, frequent cleaning, spillage of water, oil, grease, or chemical, and UV Exposure.

Surface Preparation: Allow new concrete to cure for 28 days. Mechanically abrade or Sweep Abrasive Blast Cleaning

Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24 hour period. (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative humidity should not exceed 80%. (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.")

Note: For moisture content up to 10 lbs per 1,000 sq ft or relative humidity up to 90%, Series 208 may be substituted for Series 201 as the primer.

1st Coat: 201- Epoxoprime	5.0-7.0
2nd Coat: 237-Color Tneme-Glaze	8.0-10.0
3rd Coat: 290 CRU	2.0-3.0
Dry Film Thickness	15.0- 20.0
Minimum	17.0 Mils

For a non-skid finish, broadcast 30-50 mesh clean, dry silica sand into the 2nd coat at a rate of 5 lbs per 150 square feet.

2. System No. 241/222: Decorative Quartz Flooring (Non-Slip)

This system provides a decorative, chemical, abrasion, impact resistant, non-slip, seamless flooring system with a moisture mitigating base coat that resists up to 20 lbs of moisture vapor pressure.

Surface Preparation: Allow new concrete to cure for 28 days. Mechanically abrade or Sweep abrasive Blast to provide a minimum surface profile equal to ICRI CSP3

1st Coat: 241 Ultra-Tread MVT	70 square feet per small kit
2nd Coat: 222 Deco-Tread	(1 ct. @ 1/16" ea.)
3rd Coat: 284 Tneme-Glaze (clear)	8.0 - 12.0
	Minimum Dry Film Thickness 1/8"+

3.20 POROUS MASONRY

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 156-2: Modified Epoxy - Sand Texture

Modified Waterborne Acrylate. This system offers long term protection against wind-driven rain, mold/mildew growth, chalking & fading, and bridges hairline cracks.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 157-Color Envirocrete	6.0-9.0
2nd Coat: 157 Envirocrete	6.0-9.0
Dry Film Thickness	12.0-18.0
Minimum DFT:	14.0 mils

2. System No. 104-3: High Solids Epoxy (Interior Only)

This system will produce a film thickness of 16 mils. The surface will be tile-like for easy cleaning and will provide protection against chemical attack, corrosive fumes, high humidity and wash down. Backroll first coat to fill porosity.

Surface Preparation: Surface to be clean and dry.

1st Coat: 104-Color H.S. Epoxy	8.0 - 10.0
2nd Coat: 104-Color H.S. Epoxy	8.0 - 10.0
Dry Film Thickness	16.0 - 20.0
Minimum	18.0 Mils

3. System No. 113-2: Acrylic-Epoxy Semi-Gloss (Interior Only)

Series 113 Tneme-Tufcoat has very low odor and can be used when painting in occupied areas.

Specify Series 114 Tneme-Tufcoat for a gloss finish.

Surface Preparation: Surface must be clean and dry.

1st Coat: 1254 Epoxoblock WB	125 SF/Gal
2nd Coat: 113-Color Tneme-Tufcoat*	4.0 - 6.0

	**4.0 - 6.0

** Two coats may be required if applied by roller*
*** Total Dry Film Thickness of Topcoats Only*

4. System No. 156-3: Modified Acrylic Elastomer

If texture is needed, use 157 Enviro-Crete TX For application over previously applied coatings, use TNEMEC 151 Elasto-Grip at 1.0 - 2.5 mils DFT in lieu of Series 1254.

Surface Preparation: Surfaces must be clean and dry.

1st Coat: 1254 Epoxoblock WB	125 SF/Gal
2nd Coat: 156-Color Enviro-Crete	4.0 - 8.0
3rd Coat: 156-Color Enviro-Crete	4.0 - 8.0
Dry Film Thickness	8.0 - 16.0
Minimum	10.0 Mils

3.21 GYPSUM WALLBOARD

A. INTERIOR EXPOSURE

1. System No. 113-3: Acrylic-Epoxy

Surface Preparation: Surface must be clean and dry.

1st Coat: 51PVA Sealer	1.0 - 2.0
2nd Coat: 113 H.B. Tneme-Tufcoat*	4.0 - 5.0
Dry Film Thickness	5.0 - 7.0
Minimum	6.0 Mils

*Two coats may be required if application is by brush and roller.

2. System No. 66HS-5: Hi-Build Epoxoline

Surface Preparation: Surface must be clean and dry.

1st Coat: 51PVA Sealer	1.0 - 2.0
2nd Coat: 66HS-Color Hi-Build Epoxoline*	4.0 - 6.0
Dry Film Thickness	5.0 - 8.0
Minimum	5.0 Mils

*Two coats may be required if applied by roller

3. System No. 1026--3: Acrylic Emulsion, Low Sheen (Interior/Exterior Exposure)

This system is designed for mild use areas like office walls, laboratory ceilings, stairwells, etc. For Semi-Gloss finish, use 1029-color Tneme-Cryl S/G.

Surface Preparation: Surface must be dry and clean.

1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 1026-Color Tneme-Cryl	2.0 - 3.0

Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3.22 WOOD

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 1029-2: Acrylic Emulsion Semi-Gloss

Specify Series 1028 Hi-Build Tneme-Gloss for High Gloss finish.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 10-99W Undercoater	2.0-3.0
2nd Coat: 1029 Enduratone	1.5 - 3.5
3rd Coat: 1029 Enduratone	1.5 - 3.5
Dry Film Thickness	5.0 - 10.5
Minimum	6.0 Mils

3.23 PVC PIPE

A. EXTERIOR OR INTERIOR

System No. 1095-4: Acrylic Polyurethane

Surface Preparation: SSPC-SP1 followed by hand or power sanding to scarify / degloss surface.

Two Coats: 1095 Endurashield Dry Film Thickness 2.0-3.0 mils per coat.

3.24 INSULATED PIPE

A. INTERIOR EXPOSURE

System No. 1026-4: Acrylic Emulsion, Low Sheen

For semi-gloss finish, use 1029-Color Tneme-Cryl S/G.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 1026-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3.25 HIGH HEAT COATING

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 1528-1: Inert Multipolymeric Matrix (1200 deg F Maximum)

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning - 1.5 Mil Surface Profile

1st Coat: 1528-Color Endura-Heat DTM	2.0-4.0
2nd Coat: 1528-Color Endura-Head DTM	2.0-4.0
	Dry Film Thickness 4.0-6.0

3.26 SURFACES EXPOSED TO H2S/H2SO4 (SEVERE EXPOSURE/IMMERSION) (Except for Wetwell – For Wetwell See Contract Drawings)

A. CEMENTITIOUS SURFACES

System No. 434-1: Polyamine Epoxy Mortar system

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Apply Tnemec Series 218 to all surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, mitigate concrete outgassing, and to create a monolithic, paintable surface.

1st Coat: 434 Perma-Shield	125 mils
2nd Coat: 435 Perma-Glaze	18.0-20.0
	Dry Film Thickness 143-145
	Minimum 144.0

B. FERROUS METAL SURFACES

System No. 142-1: Flake /Aluminum Oxide Filled Polyamine Epoxy

Surface Preparation: SSPC-SP-10 Near White Metal Blast Cleaning (1.5 Mil Profile)

1st Coat: Series 1 Omnithane	2.5-3.5
2nd Coat: 142 Epoxoline	14 - 18.0
	Dry Film Thickness 16.0 – 23.5.0
	Minimum 20.0 Mils

3.27 EXTERIOR OF PRESTRESSED CONCRETE TANKS

A. System No. 156-4: New Tanks

Surface Preparation: Allow new concrete to cure for at least (3) days. Surface to be clean and dry.

1st Coat: 156-Color Envirocrete	4.0 - 6.0
2nd Coat: 156-Color Envirocrete	4.0 - 6.0
	Dry Film Thickness 8.0 - 12.0
	Minimum 10.0 Mils

B. System No. 156-5: Existing Tanks (Previously Painted)

Surface Preparation: Remove all dirt, oil, grease, chalk, and loose paint per high pressure

water blast (min. 3500 psi).

1st Coat: 151 Elasto-Grip	1.0 - 2.5	
Stripe Coat: Stripe all hairline cracks with a brushed coat of Series 156 Envirocrete	3.0 - 5.0	
Topcoat: 156-Envirocrete	4.0 - 6.0	
Dry Film Thickness (Cracks)		8.0 - 13.5
Dry Film Thickness (Other)		5.0 - 8.5

3.28 SECONDARY CONTAINMENT AREAS

A. System No. 239SC-1: Modified Novolac Epoxy

This system offers superior chemical resistance to a wide range of aggressive chemicals, including Sulfuric Acid, Hydrofluosilicic Acid, Sodium Hydroxide, Sodium Hypochlorite, Polymer Emulsion, and hydrocarbons.

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24 hour period. (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative humidity should not exceed 80%. (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.") Note: For moisture content up to 10 lbs per 1,000 sq ft or relative humidity up to 90%, Series 241 may be substituted for the primer. Refer to the Series 241 product data sheet for more information.

Apply Tnemec Series 218 to all vertical surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, and to create a monolithic, paintable surface.

ApplyTnemec Series 215 or 218 as needed to fill voids in horizontal surfaces.

Primer: Tnemec Series 239SC RCK	6.0-8.0
Basecoat: Tnemec Series 239SC MCK	60.0-80.0
Fiberglass Mat: Tnemec Series 211-0215SC	NA
Saturant Coat: Tnemec Series 239SC RCK	10.0-12.0
Top Coat: Tnemec Series 282	8.0-10.0
Dry Film Thickness	84.0-110.0

Notes:

1. *See Tnemec's Fiberglass Mat Reinforced Mortar Application Guide for System details*
2. *Series 282 is not color stable. For extended color and gloss retention, apply a finish coat of Tnemec Series 290 CRU @ 2.0-3.0 mils DFT*

B. System No. 61-1: Cycloaliphatic Amine Epoxy

This system offers superior resistance to gasoline, diesel fuel, and other hydrocarbons. Use TNEMEC Series 215 between coats as a filler and surfacer wherever it is required.

Surface Preparation: Allow new concrete to cure for 28 days. Sweep abrasive blast per

SSPC-SP13 to remove all laitance, fines, curing compounds, form release oils, and other contaminants, and to establish a surface profile equal to ICRI CSP 5 or greater.

Moisture vapor transmission should not exceed three lbs per 1,000 sq ft in a 24 hour period. (Reference ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.") Relative humidity should not exceed 80%. (Reference ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes.") Note: For moisture content up to 10 lbs per 1,000 sq ft or relative humidity up to 90%, Series 241 may be applied prior to the "Primer" coat. Refer to the Series 241 product data sheet for more information.

Apply Tnemec Series 218 to all ***vertical*** surfaces at a minimum of 1/16" to re-surface concrete, fill voids and bugholes, mitigate concrete outgassing, and to create a monolithic, paintable surface.

Apply Tnemec Series 215 or 218 as needed to fill voids in ***horizontal*** surfaces.

Primer: 61-5002 Tneme-Liner (Beige)	8.0 - 12.0
Topcoat: 61-5001 Tneme-Liner (Gray)	8.0 - 12.0
Dry Film Thickness	16.0 - 24.0

3.29 CLEAR WATER REPELLENT FOR CONCRETE, MASONRY AND BRICK

A. Silane /Siloxane Sealer (Min. 42% Solids)

Surface Preparation: Allow new concrete to cure 28 days. All surfaces must be clean, dry, and free of oils, curing compounds, form release oils, and other contaminants that might interfere with the penetration of the sealer.

COATING: BRICK, CONCRETE
Tnemec Series 662 ....Two Coats @ 75-200 SF/GAL

SPLIT FACED OR POROUS MASONRY
Tnemec Series 662..... Two Coats @ 35-100 SF/GAL

3.30 CANAL PIPE (AERIAL) CROSSINGS

A. System 701-1: **NEW**. Zinc/Epoxy/Fluoropolymer for New Pipe or Existing Pipe Requiring Removal of Existing Coatings

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Primer: 90-97 Tneme-Zinc	2.5 - 3.5	
2nd Coat: 66HS-Color Hi-Build Epoxoline	2.0 - 3.0	
3rd Coat: 701-Color Hydroflon	2.0 - 3.0	
	Dry Film Thickness	6.5 - 9.5
	Minimum	8.0 Mils

B. System No. 701-2: **EXISTING**. High Build, Semi- Gloss Fluoropolymer for Marginally Cleaned Surfaces or Topcoating Over Existing Systems

Surface Preparation: High Pressure Water Blast (min. 3500 psi) or Solvent Clean (SSPC-SP1) and Spot Hand or Power Tool Clean (SSPC-SP 2 - 3) or Brush Blast (SSPC-SP7).

Existing coatings must be clean, dry and tightly adhering prior to application of coatings.

Spot Coat: 135-Color Chembuild	3.0 - 5.0
Prime Coat: 135-Color Chembuild	3.0-5.0
2nd Coat: 701-Color Hydroflon	2.0 - 3.0

Minimum Dry Film Thickness (NIC Spot Coat)? 6.0

3.32 PROJECT DESIGNER SYSTEMS REFERENCE GUIDE

A. STEEL

EXTERIOR (NON-IMMERSION)

A.1 System No. 1095-1-1: Epoxy/High Build Urethane
A.2 System No. 1095-2: High Build Urethane
A.4 System 90-97: Zinc/Epoxy/Urethane

INTERIOR EXPOSURE (NON-IMMERSION)

B.1 System No. 66HS-1: High Solids Epoxy
B.2 System No. 66HS-2: High Build Epoxy

IMMERSION

C.1 System No. 104-1: High Solids Epoxy (Non-Potable)
C.2 System No. 20HS-1: High Build Epoxy (Non-Potable)
C.3

B. OVERHEAD METAL DECKING, JOIST (INTERIOR EXPOSURE)

System No. 115-1: Uni-Bond

C. OVERHEAD METAL DECKING, JOINT (EXTERIOR EXPOSURE)

System No. 1029-1 Enduratone

D. GALVANIZED STEEL-PIPE AND MISCELLANEOUS FABRICATORS

System No. 1095-3: Epoxy/High Build Urethane

E. GALVANIZED STEEL-INTERIOR EXPOSURE (NON-IMMERSION) AND ALUMINUM IN CONTACT WITH CONCRETE

System No. 66HS-3: Polyamide Epoxy

F. CONCRETE

EXTERIOR-ABOVE GRADE

A.1 System No. 1026-1: Acrylic Emulsion Low Sheen
A.2 System No. 156-1: Modified Acrylic Elastomer

EXTERIOR-BELOW GRADE

B.1 System No. 46-61: Coal Tar Pitch Solution
B.3

EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

C.1 System No. 1026-2: Acrylic Emulsion Low Sheen
C.2 System No. 66HS-4: Epoxy-Polyamide

IMMERSION (POTABLE & NON-POTABLE)

D.1 System No. 104-2: High Solids Epoxy (Non-Potable)

D2 System No. 20HS-2: Epoxy Polyamide (Potable)

INTERIOR EXPOSURE (NON-IMMERSION)

E.1 System No. 66HS-5: High Solids Epoxy
E.2 System No. 113-1: Acrylic Epoxy Semi-Gloss

J. CONCRETE FLOORS

A.1 System No. 290-1: Epoxy-Polyamide
A.5 System No. 241/222: Decorative / Functional Flooring (Non-Slip)

K. POROUS MASONRY - EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 156-2: Modified Epoxy-Sand Texture
A.2 System No. 104-3: High Solids Epoxy (Interior Only)
A.3 System No. 113-2: Acrylic Epoxy Semi-Gloss (Interior Only)
A.4 System No. 156-3: Modified Acrylic Elastomer

L. GYPSUM WALLBOARD

A.1 System No. 113-3: Acrylic Epoxy
A.2 System No. 66HS-5: Hi-Build Epoxoline
A.3 System No. 1026-3: Acrylic Emulsion, Low Sheen

M. WOOD EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 1029-2: Acrylic Emulsion Semi-Gloss
A.2 System No. 6-5: Acrylic Latex

N. PVC PIPE EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 1095-5: Acrylic Polyurethane

O. INSULATED PIPE-INTERIOR EXPOSURE

A.1 System No. 1026-4: Acrylic Emulsion, Low Sheen

P. HIGH HEAT SURFACES-FERROUS METAL

A.1 System No. 1528-1: Silicone Aluminum (1200deg F Maximum)

Q. SURFACES EXPOSED TO H_2S/H_2SO_4 (SEVERE EXPOSURE/IMMERSION)

A.1 System No. 434-1: Polyamine Epoxy Mortar Systems
A.2 System No. 142-1: Flake / Aluminum Oxide Filled Polyamine Epoxy

R. EXTERIOR OF PRESTRESSED CONCRETE TANKS

A. System 156-4 New Tanks
B. System 156-5: :Existing Tanks (Previously Painted)

S. SECONDARY CONTAINMENT AREAS

A. System No. 239SC-1: Modified Novolac Epoxy
B. System No. 61-1: Cycloaliphatic Amine Epoxy

T. CLEAR WATER REPELLENT FOR CONCRETE, MASONRY AND BRICK

A. Silane /Siloxane Sealer (Min. 42% Solids)

V. CANAL PIPE (AERIAL) CROSSINGS

A. System No. 701-1: Zinc/Epoxy/Fluoropolymer
B. System No. 701-2: High Build/Fluoropolymer
C. Ductile Iron Pipe Above Grade: Series 66 High Build Epoxy

3.33 COATING SCHEDULE - TO BE DEVELOPED BY PROJECT AS NEEDED

END OF SECTION

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SECTION 09901 ROOF COATING AND MEMBRANE SYSTEM - NOXYDE

PART 1 GENERAL

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install and test the coating and membrane system complete and ready for service as listed in the specifications and as shown on the Drawings.

The coating and membrane system consists of special V.O.C. compliant, 100% U.V. resistive anti-corrosion coating(s) and surface preparation as shown in the attachments and as specified herein.

B. The work includes installing a coating and membrane system of all new materials. This includes, but is not limited to:

1. Metal Standing Seam Roof: The entire metal standing seam roof including valleys, ridges, penetrations and the fascias and gutters.
2. Built Up Roof:
   a. The entire built-up roof area shall be recoated as noted herein.
   b. All parapet walls from the metal coping to roof cove and all roof top mechanical equipment penetrations, exhausts, scupper, drain, etc., shall be properly flashed at the base to the roof surface in accordance with manufacturer's recommended details. Membrane shall extend approximately one foot onto the roof surface.

C. All other work obviously required to be coated unless otherwise specified herein or on the Drawings. The omission of minor items in the Schedule of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

1.02 RELATED WORK

A. Surface cleaning is the responsibility of the General Contractor.

B. Contractor shall ensure that all debris is disposed of properly; provide appropriate barricades and protection to allow traffic and pedestrian traffic flow without obstruction to the work area; and ensure proper protection is provided so that no overspray will occur during the cleaning phase or the coating phase of this project.

C. Contractor shall confer and coordinate with County as to loading and unloading, storage areas, dumpsters, etc., so as not to interfere with the office operation. Dumpsters for this work shall be provided by the Contractor and included in this bid.

D. Power and water for surface preparation and coating and membrane application is available for use by the Contractor for this project. Contractor shall confer and coordinate this with the County. All power extensions and water hoses shall be the responsibility of the Contractor as shall the use of same. If the power or water sources are inadequate, then the Contractor shall provide alternate sources at his expense.

E. Contractor shall provide and coordinate toilet facility location with the County.

F. All required regulations of OSHA are to be adhered to and are made part of this specification.

Protective gear is to be worn at all times according to the regulations of OSHA as defined by the work method involved.

G. The County's property protection is mandatory and is the responsibility of the Contractor. The Contractor shall provide for the safety of all persons in and or around the work site during all phases of the work. The Contractor shall coordinate ALL his activities with the County at all times.

H. Surface preparation and coating and membrane application will be addressed in future sections of these specifications. Coating and membrane system(s) must be installed at temperatures above 45 degrees F. and rising. Coating and membrane system(s) need 24 hours for full cure. The Contractor shall insure that no foreign products, oil, gas, steam, etc., come in contact with coating and membrane system(s) for at least 24 hours. Coating and membrane system(s) should not be installed when rain is expected within fours hours of application.

I. Coating and membrane system(s) are non-toxic. Mixing and application by brush, roller or airless spray can be done in an enclosed environment without any need for fresh air. Normal spray masks should be used during application. No special precautions need to be used for hands and skin when in contact with coating and membrane system(s).

J. Coating and membrane system(s) remain water soluble. Spray equipment, brushes, and rollers can be cleaned up with water. After 30 minutes, coating and membrane system(s) will dry and then paint thinners would be used for cleaning.

1.03 SUBMITTALS

A. Submit to the County, shop drawings and schedules of the coating and membrane system and appurtenances required. Submit design data and specification data sheets listing all parameters used in the coating and membrane system design and thickness calculations based on applicable provisions of ASTM or other expected standards.

B. Submit the following information and material for approval prior to commencing the work and delivering product to the project:

1. Coating and membrane system(s) manufacturer's data sheets and samples of each finish and color;
2. Complete progress schedule of surfaces to be coated and shall identify the proposed surface preparation, coating and membrane system(s), mobilization, cleanup and demobilization.

C. Test reports.

1.06 GUARANTEE

A. All surfacing shall be guaranteed by the Contractor for a period of ten years from the date of acceptance. During this period, all defects discovered in the surfacing, as determined by the County, shall be repaired or replaced in a satisfactory manner at no cost to the County.

B. The Contractor shall provide Manufacturer's standard warranty for all materials and labor for a period of ten (10) years after the date of acceptance by the County. Mathys, ACT-Martco and the Contractor shall be responsible for all rusting, delamination, cracking, and peeling from the substrate under normal conditions and in accordance with the manufacturer's standard form of

warranty for such projects. The Contractor shall be responsible for the first three years of this warranty and Mathys/ACT-Martco shall be responsible for the last seven years of this warranty.

1.07 QUALITY ASSURANCE

A. All surfacing products shall be from a single manufacturer.

B. Inspections of the material may also be made by the County or other representatives of the County after delivery. The material shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample may have been accepted as satisfactory at the place of manufacture. Materials rejected after delivery shall be marked for identification and shall be removed from the job at once.

C. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

D. The Contractor shall employ specialty workers who have proven ability to perform the Work included herein. This will consist of a minimum of two years or two project experiences installing this product. This is a requirement for each and every employee.

E. Use equipment adequate in size, capacity and number sufficient to accomplish the Work of this Section in a timely manner.

F. In addition to complying with requirements of governmental agencies having jurisdiction; comply with the directions of the County.

1.08 DELIVERY, STORAGE AND HANDLING

A. Coating, membrane components and primer shall be delivered in unopened containers. They shall be shipped at temperatures above freezing as they are water based.

B. Polyester Reinforcement Mesh shall be delivered in rolls from 10 inches to 39 inches wide. Bridging mesh shall be delivered in rolls about 9 inches wide.

C. Coating, membrane components and primer must be stored at temperatures above freezing and out of the weather. The containers must remain unopened until ready to be used.

D. Care shall be taken in shipping, handling and placing to avoid damaging. Any material damaged in shipment shall be replaced as directed by the County.

E. Any material showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work.

PART 2 PRODUCTS

2.01 COATING SURFACE SYSTEM

A. The coating surface system shall be equal to those manufactured by Martin Mathys, S.A., nationally distributed by ACT-Martco, Elmsford, New York, distributed in Florida by Marvin A. Flam, Palm Harbor, FL, (813) 934-4485 or equal. Products of other manufacturers comparable in quality and type to those specified shall be considered if the manufacturer provides, in

writing, satisfactory proof on past performance of similar applications and with sufficient data substantiated by certified tests to demonstrate its equality to the coatings named. The written acceptance by the County shall be obtained before any such alternate products are ordered by the Contractor.

2.02 METAL STANDING SEAM ROOF

A. VOC compliant water based Anti-Corrosion Coating shall be NOXYDE as manufactured by Martin Mathys, S.A., and nationally distributed by ACT-Martco, Elmsford, New York.

NOXYDE is a one part, self priming, fluid applied, seamless, flexible, waterproof system, applied over clean, tight rust or clean old coatings (including lead paint). Existing metal shall be properly cleaned leaving a sound, contaminant free substrate prior to the application of the anti-corrosion coating. Coating is cold applied, fluid anti-corrosion system for steel and metal surfaces. Coating is one part product, packed in 20 kilo units. Coating system is a self priming system that cures to a fully seamless, flexible, 100% waterproof, 100% U.V. resistant system.

B. Final coat shall be PEGACRYL as manufactured by Martin Mathys, S.A., and nationally distributed by ACT-Martco, Elmsford, New York. PEGACRYL is a one-part, water-based acrylic coating containing 26% resin emulsions and fee of internal or external plasticized polyvinyl acetate.

C. Reinforcing mesh shall be polyester open weave mesh M107, 6" wide mesh x 320 feet. Reinforcement is used for special conditions, to bridge large cracks, holes, etc., and can be used to seal joints, seams and other areas where water entry must be stopped.

D. Elastic Sealant shall be ELASTOFILL as manufactured by Martin Mathys, S.A., nationally distributed by ACT-Martco, Elmsford, New York. The waterproof sealant is discharged from caulking tube. ELASTOFILL is a one-part, water-borne acrylic malleable paste which, after complete cure, forms a highly elastic, rubber-like, 100% waterproof joint sealant, showing a permanent elasticity, complete impermeability to water, a resistance to alkaline substances, resistance to aging and long term weathering as well as resisting temperatures up to 230 degrees F. without sagging.

E. Physical Properties and MSDS sheets are available from manufacturer.

2.03 BUILT UP ROOF

A. VOC compliant water based Seamless Roof System shall be DAKFILL as manufactured by Martin Mathys, S.A., nationally distributed by ACT-Martco, Elmsford, New York.

1. Coating is one part, water-borne acrylic, liquid-applied seamless rubber roofing system. It contains no tar, no asphalt or bitumastic materials. This fully adhered system can be applied over any sound, dry substrate and is unaffected by heat, frost, industrial pollution, UV rays, and long term weathering. DAKFILL can stand ponding water on flat roofs. Coating is a one part product, packaged in 25 kilo units which will provide 125 S.F. coverage for the two coat system over flat roofs and parapets dependent on surface texture and porosity. Existing substrate shall be properly cleaned leaving a sound, contaminant free substrate prior to the application of the seamless roofing system coating. Membrane system is a self priming system that cures to a fully seamless coating which is 100% waterproof, 100% U.V. resistant and flexible. Reinforcing mesh can be used in special situations to take care of highly damaged roofs and parapet walls or large cracks in the system.

B. Reinforcing mesh shall be polyester open weave mesh 8" or 48" wide mesh x 320 feet. Reinforcement is used for special conditions, to bridge large cracks, holes, etc. and can be used to seal joints, seams and other areas where water entry must be stopped.

C. Elastic Sealant shall be ELASTOFILL as manufactured by Martin Mathys, S.A., nationally distributed by ACT-Martco, Elmsford, New York. The waterproof sealant is discharged from caulking tube. ELASTOFILL is a one-part, water-borne acrylic malleable paste which, after complete cure, forms a highly elastic, rubber-like, 100% waterproof joint sealant, showing a permanent elasticity, complete impermeability to water, a resistance to alkaline substances, resistance to aging and long term weathering as well as resisting temperatures up to 230 degrees F. without sagging.

D. Top coat shall be PRT COATING as manufactured by Martin Mathys, S.A., nationally distributed by ACT-Martco, Elmsford, New York. PRT COATING is a one part solvent acrylic finish coat, non-saponifiable, that can be applied directly to new concrete or used as a top coat for DAKFILL roof finishes.

E. Physical Properties and MSDS sheets are available from manufacturer.

2.04 COLORS

A. Color of each product for each application shall be selected by the COUNTY and provided to the CONTRACTOR prior to his placing order for product. The color selection shall be from standard colors by the manufacturer. The product shall be delivered to the Contractor already color mixed and properly identified. CONTRACTOR shall mix product thoroughly to insure uniform color throughout.

PART 3 EXECUTION

3.01 INSTALLATION

A. Work for this project shall be carried out in accordance with all Local, State, Federal Laws and Regulations with the most restrictive laws or regulations being followed. CONTRACTOR shall comply with all ordinances regarding dust, debris and noise and shall be required to adhere to same. Permits, inspections, and appropriate certificates as required by the work under this contract shall be obtained by and paid for by the CONTRACTOR.

B. Coating and membrane system must be installed by an applicator familiar with the coating or membrane system as well as under the guidance of the manufacturer. Inspections will be made by the manufacturer's authorized technical consultant throughout the Project and final inspections will be conducted by the regional or national technical consultants of the manufacturer with the CONTRACTOR. CONTRACTOR shall coordinate with the manufacturer's technical inspector for times and applications phase terminations so that inspections may occur without delaying the next phase of the application. A final inspection will ascertain that the Coating or Membrane System has been installed in accordance with the specifications for the project. No deviations will be allowed from the manufacturer's specifications, unless these changes are submitted and approved in advance by the County in conjunction with the manufacturer's technical consultant prior to the start of the project application.

C. CONTRACTOR shall familiarize himself with all aspects of the job prior to providing his bid proposal for the project. He shall proceed with the work in an orderly and prompt manner upon

authorization. He shall commence with the work as required minimizing noise and other disturbances to the normal operation of the office facility. He shall remove all debris immediately from the area so that the wind does not carry the debris beyond the work area.

PART 3 APPLICATION

3.01 METAL STANDING SEAM ROOF

A. SURFACE PREPARATION

1. Pressure wash entire surface with 3000 psi at 180 degrees F. hot water and Dirt Killer DK Spinner Tip or Turbo-tip at point blank range. As soon as surface is dry, coating work can begin.
2. Hand scrape or wire brush any heavy rust areas, catching any hazardous particles.
3. Feather edge around the old coating to relieve the pressure of lift off.
4. Remove excess oil and grease (if any) with TSP or other detergents. As soon as surface is dry, coating work can begin.

B. APPLICATION

1. ELASTOFILL is applied over all fasteners and along panel joints and seams.
2. Six inch reinforcing mesh and NOXYDE at 13 mils wet is applied to all open joints, over copings, roof plane connections where there is movement and at transition and along edges as required to totally seal the roof, yet allow it to move.
3. NOXYDE (Color #1) diluted by 33% water is sprayed as a fog coat over the entire standing seam metal roof and fascia surface at a 2 dry mill thickness for adhesion.
4. NOXYDE (Color #2) is sprayed with airless spray at 13 mills wet over entire standing seam metal roof and fascia surface.
5. PEGACRYL (Final Color) is sprayed as the final coat with airless spray at 5 wet mils over the entire standing seam metal roof and fascia surface.
6. Final PEGACRYL coat can be sprayed over first coat after overnight drying. If more than two (2) days elapse between the first and second coats, light water wash is recommended to remove and dirt and salt contamination of the first coat.

3.02 BUILT UP ROOF

A. PREPARATION

1. Remove all water damaged insulation and replace it in a proper manner to original roof height. All surfaces shall be sound, clean and dry before proceeding with the application.
2. Chip off any alligatored surfaces to leave a smooth work surface. Remove all loose and damaged paper. Seal up any cracks, holes and flashing areas to make them watertight. Use star cut repair on any blisters.
3. Sweep up all dirt AND DEBRIS in work area before pressure wash.
4. Verify that all roof drains, gutters and leaders are not clogged prior to hot water pressure wash. Pressure wash the area to be repaired with 180 degrees F. hot water minimum pressure of 1500 psi to eliminate any salts and bacteria and allow to dry thoroughly for at least 24 hours before proceeding with the work.
5. In areas of ponding water in the work area, scrub vigorously using one (1) part chlorine and three (3) parts water to kill embedded microorganisms in the work surface. TSP can be added to this mix to remove oil, grease, dirt and other latents. These areas shall be re-rinsed before application.

B. APPLICATION

1. PARAPET WALLS: Starting at the fascia of the metal coping, use the flashing mesh and DAKFILL to bridge these joints, seal them up, yet allow them to move and flex in the future. DAKFILL membrane can be extended with roller or brush, over the inside area of the parapet wall using flashing mesh and extended at least 12 inches onto roof deck. ELASTOFILL should be applied into the cracks as filler material before mesh and DAKFILL are applied.
2. REGLET FLASHING: Bridging mesh and DAKFILL is applied over the REGLET Flashing on the wall, making a flexible "bridge" over this area.
3. COVE AREA OF ROOF: Using the 18-inch wide mesh, coating the cove area of the roof shall be completed and cut in prior to starting the spray application of DAKFILL. Work area shall extend at least 12 inches onto roof deck.
4. DRAIN and SCUPPER: Shall be flashed with reinforcing mesh and DAKFILL. The work shall be cut in accordance with manufacturer's details. Drain shall be flashed into the throat of the drain and up onto at least 12 inches of the roof deck.
5. MECHANICAL EQUIPMENT, PENETRATIONS, ETC.: DAKFILL with flashing mesh shall be applied around all penetrations using scissors to cut scalloped legs into the mesh so it will free-form itself around the penetration and reinforce the membrane in the joint area. ELASTOFILL should be added to form a rubbery bumper right in the 90 degree angle of this work. DAKFILL and mesh can be applied directly and immediately over the ELASTOFILL. Work should extend at least 12 inches onto roof deck and over top of base. All rusted areas should be coated with one coat of NOXYDE at 13 wet mils.
6. Once the flashing and specialty work is completed, the first coat of DAKFILL is applied. Apply DAKFILL thru 48 inch mesh, using roller application onto deck surface. First coat is applied so that all holes in mesh are filled up. Let dry overnight.
7. Apply second coat of DAKFILL to obliterate mesh, and let dry 48 hours. This can be done with roller or airless spray (21-26 tip) and left to cure overnight.
8. Apply sealer coat of White PRT over entire flat surface at 3-4 wet mils thickness.

PART 4 WORKMANSHIP

A. The Contractor shall be responsible for the cleanliness of his coating operations and shall use covers and masking tape to protect the new and existing material not intended to be coated whenever such covering is necessary, or if requested by the County. Any coatings identified for removal shall be carefully removed without damage to any finished coatings or surface. If damage does occur, the entire surface, adjacent to and including the damaged area, shall be re-coated without visible lapmarks and without additional cost to the County.

B. Coating found defective shall be removed and re-coated as required by the County. Before final acceptance of the Work, damaged surfaces shall be cleaned and re-coated as directed by the County.

C. CLEANUP: The buildings and other Work areas shall be kept free from accumulation of waste material and rubbish caused by the work. At the completion of the coating work, all tools, equipment, scaffolding, surplus materials, and all rubbish around the building(s) shall be removed and the work area left broom clean unless otherwise specified.

END OF SECTION

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SECTION 09970 SURFACE PROTECTION SPRAY SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install and test the coating system complete and ready for operation for the structures listed in the specifications and as shown on the Drawings.

B. The work includes coating of all surfaces as shown and specified on the Drawings. This includes, but is not limited to stairs, walls, floors, concrete divider, concrete slabs, manholes wet wells, and all other work obviously required to be coated unless otherwise specified herein or on the Drawings. The omission of minor items in the Schedule of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

1.02 RELATED WORK

A. Bypass pumping is the responsibility of the General Contractor.

B. Concrete surface cleaning in each lift station is the responsibility of the General contractor.

C. Removal and offsite disposal of rubble is the responsibility of the General Contractor.

1.03 SUBMITTALS

A. Submit to the County shop drawings and schedules of all surfacing systems and appurtenances required. Submit design data and specification data sheets listing all parameters used in the surfacing system design and thickness calculations based on applicable provisions of ASTM.

B. Submit to the County the name of the surfacing supplier, a list of materials to be furnished, and the qualification (per 1.05 A) of the application contractor.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

ASTM D-638
ASTM D-790

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALIFICATIONS

A. The Contractor performing the surfacing work shall be fully qualified, experienced a minimum of seven years and equipped to complete this work expeditiously and in a satisfactory manner. The Contractor shall submit the following information to the County for review and approval before any surfacing work is performed.

1. The number of years of experience in performing this type of specialized work must

be seven years minimum.

2. Name of the surfacing manufacturer and supplier for this work and previous work listed below. The Contractor shall be an approved installer as certified and licensed by the surfacing manufacturer and equipment supplier.

3. A list of clients that the Contractor has performed this type of work.

   a. The list shall contain names and telephone numbers of persons who can be called to verify previous satisfactory performance.

   b. Installation dates and a description of the actual work performed.

   c. The surfacing manufacturer shall provide an installation list of his product used for similar sewer rehabilitation projects. The list shall provide the same information as required in paragraphs 3.a and 3.b above.

B. The County reserves the right to approve or disapprove the Contractor, based on the submitted qualifications.

1.06 GUARANTEE

All surfacing shall be guaranteed by the Contractor for a period of five years from the date of acceptance. During this period, all defects discovered in the surfacing, as determined by the County, shall be repaired or replaced in a satisfactory manner at no cost to the County, this shall include, but is not limited to, all work and costs associated with the shut down of any pump stations and all bypass operations needed for the proper repairs to be made.

1.07 QUALITY ASSURANCE

A. All surfacing products shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM Standards D-638 and D-790 as applicable.

B. The Contractor shall employ specialty workers who have proven ability to perform the Work included herein. This will consist of a minimum of two years or two project experiences installing this product. This is a requirement for each and every employee.

1.08 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in shipping, handling and placing to avoid damaging. Any material damaged in shipment shall be replaced as directed by the County.

B. Any material showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work.

PART 2 PRODUCTS

2.01 GENERAL

A. The material sprayed onto the surface shall be a urethane resin system formulated for the application within a sanitary sewer environment. The urethane will exhibit suitable corrosion

resistance to corrosive gases and fluids found within domestic sanitary sewage. Unless dictated by varying effluent, the spray system shall be a urethane and exhibit the cured physical strengths specified herein.

B. When cured, the surface coating shall form a continuous, tight-fitting, hard, impermeable surfacing data which is suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage.

C. The surface shall be an integral part of the structure being rehabilitated after being placed and cured. The surface shall cover the complete interior of the existing structure. The surface shall provide a continuous watertight seal or barrier.

1. The surface shall effectively seal the interior surfaces of the structure and prevent any penetration or leakage of groundwater infiltration.

2. Provide water resistance data on surface based on ASTM Standards.

3. The surface shall be compatible with the thermal conditions of existing sewer lift stations and manholes. Surface temperature will range from 30 to 80 degrees F. Provide test data on thermal compatibility based on ASTM Standards.

2.02 MATERIALS

A. Approved materials include

1. Raven Lining Systems
2. GLM Coatings

B. Polyurethane spray application shall comply with the following specifications:

The cured urethane system shall conform to the minimum physical standards, as listed below. The long-term data is for a 50-year design life of the process.

Cured Urethane	Standard	Long-Term Data
Tensile Stress	ASTM D-638	5,000 psi
Flexural Stress	ASTM D-790	10,000 psi
Flexural Modulus	ASTM D-790	550,000 psi

C. Epoxy spray application shall be 100% VOC free / 100% solids.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. The contractor shall clean each structure and shall dispose of any resulting material.

B. All contaminants including: oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.

C. All concrete or mortar that is not sound or has been damaged by chemical exposure shall

be removed to a sound concrete surface or replaced.

D. Surface preparation method(s) should be based upon the conditions of the substrate, service environment and the requirements of the protective coating to be applied.

E. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with a high pressure water cleaning using equipment capable of 3,000 psi at 4 gpm. Other methods such as abrasive blasting, shotblasting, grinding, scarifying or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound clean neutralized surface that is not excessively damaged.

F. A concrete structure suitably prepared for coating shall have all loose, soft, discolored or otherwise deteriorated material removed from the manhole and the surface profile of the manhole shall be in accordance with ICRI Guidelines No. 03732. Expose aggregate and obtain a uniform surface texture resembling an ICRI – CPS (Concrete Surface Profile) #4-6. The County may use one or more of the following observations/tests to determine whether the manhole substrate has been properly cleaned and prepared:
   a. Visual appearance of the manhole – The prepared substrate shall have the appearance of sound concrete, free from discolored, white, chalky and cracked areas.
   b. Aural observations – When struck with a metal hammer or similar metal tool, the prepared substrate shall exhibit the characteristic sound of solid, competent concrete (or brick). Care should be taken not to fracture sound concrete.
   c. Mechanical abrasion tests – The substrate should be competent enough such that it cannot be scraped off with the claw of a hammer or similar metal tool.
   d. pH testing – The County may use wetted litmus paper applied to the surface of the substrate to ensure that the pH of the substrate is 9 or higher.
   e. Phenolthalein testing – The County may apply a few drops of phenolthalein to the surface of the concrete, which if the concrete is competent should yield a purple color.

G. The County is not obligated to use all of the above tests, but may do so at the County's sole discretion. Often visual, mechanical and/or aural observations and tests alone will be adequate, but the pH and/or phenolthalein tests may be used if there is still some uncertainty.

H. If after cleaning, a new or existing manhole does not meet these requirements, the County shall have authority to require additional cleaning effort and/or increased blasting pressure as required to adequately prepare the manhole. If necessary, the County may also require acid etching of the concrete surface to create the desired texture. For existing manholes, the County may also require mechanical removal of deteriorated concrete or other substrate materials.

I. A mild chlorine solution may be used to neutralize the surface to diminish microbiological bacteria growth prior to final rinse and coating system if approved by the Manufacturer's Representative.

J. The time between structure cleaning and preparation activities and application of the first coating layer shall be within the coating manufacturer's recommendation.

K. All infiltration shall be stopped by using a material which is compatible with and is suitable

for topcoating with the specified protective coating.

L. The area between the manhole and the manhole ring and any other area that might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible grout or gel before surface coating spray application.

M. All surfaces should be inspected by the Inspector during and after preparation and before the repair material is applied.

N. No separate payment shall be made for any preparatory work required prior to application of the surface coating.

3.02 INSTALLATION

A. The Contractor shall notify the Project Manager at least 48 hours in advance, giving the date, start time and estimated completion time for the work being conducted.

B. The Contractor shall provide bypass pumping of sewage flows (as required) where and when the rehabilitation work is being performed. No flows will be permitted in the structure until the spray coating has properly cured to the manufactures specifications.

C. The installation of the surface coating shall be in complete accordance with the applicable provisions of ASTM and the manufacturer's specifications. A representative of the manufacturer shall be present during the actual installation.

1. Prior to placing the surface coating, the manufacturer's representative must approve the surface preparation work and installation conditions including temperatures.

2. All surfaces shall be sufficiently smooth and even, to ensure good flow handling characteristics when complete.

3. All surfaces shall have the surface coating applied to the required thickness by spray application.

D. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.

E. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.

F. The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer.

G. Polyurethane spray application shall be applied such that all surfaces shall be coated in accordance with the manufactures recommended thickness but not be less than 125 mils.

H. Epoxy spray application shall be applied such that all surfaces shall be coated in accordance with the following:

1. Specified surfaces shall be coated by spray application of a moisture tolerant, solvent-free, 100% solids, epoxy protective coating as further described herein.

Spray application shall be to a minimum wet film thickness in accordance Sheet 6 of Bid Set Drawings with the following table or manufacturer's recommendation, whichever is greater.

2. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. Air assisted spray application equipment may be acceptable, especially for thinner coats (<10 mils), only if the air source is filtered to completely remove all oil and water.

3. If necessary, subsequent topcoating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

3.03 FIELD TESTING AND ACCEPTANCE

A. Field acceptance of surface coatings shall be based on the County's evaluation of the proper surfacing of the structure and the appropriate installation and curing test data along with review of the structure inspections.

B. The surface coatings shall provide a continuous monolithic surfacing with uniform thickness throughout the structure interior. If the thickness of the coating surface is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the County.

1. The County will measure the surface cured thickness from a specimen retrieved by the Contractor. The Contractor shall retrieve the specimen by physically cutting through the surfacing (by drilling or coring). There will be up to three thickness measurement locations in each structure. A suitable non-destructive type of thickness measurement may also be used.

2. All the surface coating thickness measurement locations shall be repaired by the Contractor in accordance with the manufacturer's recommendations. These repairs shall be included in the five year surface coating guarantee.

C. All pipe connections shall be open, clear, and watertight.

D. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects.

E. If any defective surface coating is discovered after it has been installed, it shall be repaired or replaced in a satisfactory manner within 72 hours and at no additional cost to the County. This requirement shall apply for the entire five year guarantee period.

END OF SECTION

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SECTION 11000 GENERAL REQUIREMENTS FOR EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE

This section specifies general requirements which are applicable to all mechanical equipment. The Contractor is responsible for ensuring that all mechanical equipment meets the requirements of this section in addition to the specific requirements of each individual equipment specification section.

B. EQUIPMENT LISTS

Equipment lists, presented in these specifications and as specified on the drawings, are included for the convenience of the Contractor and are not complete listings of all equipment, devices and material required to be provided under this contract. The Contractor shall prepare his own material and equipment takeoff lists as necessary to meet the requirements of this project manual.

1.02 QUALITY ASSURANCE

A. ARRANGEMENT

The arrangement of equipment shown on the drawings is based upon information available to the County at the time of design and is not intended to show exact dimensions conforming to a specific manufacturer. The drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revision to meet actual submitted equipment installation requirements; these may vary significantly from manufacturer to manufacturer. The contractor shall, in determining the cost of installation, include these differences as part of his bid proposal. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be altered to accommodate the equipment actually provided. No additional payment shall be made for such revisions and alterations.

B. REFERENCES

This section contains references to the documents listed below. They are a part of this section as specified and modified. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents

shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, has been discontinued or has been replaced.

Reference	Title
ABMA Std 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA Std 11	Load Ratings and Fatigue Life for Roller Bearings
ANSI B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Gray Iron Pipe Flanges and Flanged Fittings, (Classes 25, 125, and 250)
ANSI B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ANSI S2.19	Mechanical Vibration – Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Unbalance, Including Marine Applications

C. UNIT RESPONSIBILITY

The Contractor shall require equipment assemblies made up of two or more components to be provided as a working unit by the unit responsibility manufacturer, where specified. The unit responsibility manufacturer shall coordinate selection, coordinate design, and shall provide all mechanical equipment assembly components such that all equipment components furnished under the specification for the equipment assembly, and all equipment components specified elsewhere but referenced in the equipment assembly specification, is compatible and operates reliably and properly to achieve the specified performance requirements. Unless otherwise specified, the unit responsibility manufacturer shall be the manufacturer of the driven component equipment in the equipment assembly. The unit responsibility manufacturer is designated in the individual equipment specifications found elsewhere in this project manual. Agents, representatives, or other entities that are not a direct division of the driven equipment manufacturing corporation shall not be accepted as a substitute for the driven equipment manufacturer in meeting this requirement. The requirement for unit responsibility shall in no way relieve the Contractor of his responsibility to the County for performance of all systems.

The Contractor shall ensure that all equipment assemblies provided for the project are products for which unit responsibility has been accepted by the unit responsibility manufacturer(s), where specified. Unit responsibility for related components in a mechanical equipment assembly does not require or obligate the unit responsibility manufacturer to warranty the workmanship or quality of component products not manufactured by them. Where an individual specification requires the Contractor to furnish a certificate from a unit responsibility manufacturer, such certificate shall conform to the content, form and style of Form 11000-C specified in Section 01999, shall be signed by an officer of the unit responsibility manufacturer's corporation and shall be notarized. No other submittal material will be processed until a Certificate of Unit Responsibility has been received and has been found to be satisfactory. Failure to provide acceptable proof that the unit responsibility requirement has been satisfied will result in withholding approval of progress payments for the subject equipment even though the equipment may have been installed in the work.

D. BALANCE

Unless specified otherwise, for all machines 10 HP and greater, all rotating elements in motors, pumps, blowers and centrifugal compressors shall be fully assembled, including coupling hubs, before being statically and dynamically balanced. All rotating elements shall be balanced to the following criteria:

$$U_{per} = 6.015 \frac{GW}{N}$$

Where:

U_{per} = permissible imbalance, ounce-inches, maximum

G = Balance quality grade, millimeters per second

W = Weight of the balanced assembly, pounds mass

N = Maximum operational speed, rpm

Where specified, balancing reports, demonstrating compliance with this requirement, shall be submitted as product data. Equipment balance quality grade shall be G2.5 (G = 2.5 mm/sec) or better in accordance with ANSI S2.19.

PART 2 PRODUCTS

2.01 FLANGES AND PIPE THREADS

Flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI B16.1, Class 125. Pipe threads shall conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.

Threaded flanges shall have a standard taper pipe thread conforming to ANSI B1.20.1. Unless otherwise specified, flanges shall be flat faced.

Flange assembly bolts shall be heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Threads shall be Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

2.02 BEARINGS

Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified. Each bearing shall be rated in accordance with the latest revisions of ABMA Methods of Evaluating Load Ratings of Ball and Roller Bearings. Unless otherwise specified, equipment bearings shall have a minimum L-10 rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.

Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes

shall be used when necessary. Grease supply fittings shall be standard hydraulic alemite type.

Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C and shall be equipped with one drain and one inspection plug that are accessible from the exterior of the motor unit

All bearings accessible to touch, and located within working level or within 15 inches measured horizontally from stairways, ramps, fixed ladders or other access structures, shall either incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature or shall be provided with appropriate shielding shall be provided that will prevent inadvertent human contact.

2.03 V-BELT ASSEMBLIES (NOT USED)

2.04 PUMP SHAFT SEALS

A. GENERAL

Seals for water and wastewater pump shafts shall be mechanical seals.

B. MECHANICAL SEALS

The shaft seal shall be a positively driven dual, tandem mechanical shaft seal system consisting of two seals, each having an independent spring system. The seal is in a separate lubricant chamber and is lubricated and cooled by environmentally friendly medical white oil. The lubricant chamber shall be designed to prevent over-filling and shall provide capacity for lubricant expansion. The seal system shall not rely upon the pumped media for lubrication. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counterclockwise direction of rotation without damage or loss of seal function. The rotating inner seal ring shall have small back-swept grooves laser inscribed upon its face to act as a micro pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. Shaft seals without positively driven tandem mechanical seal or conventional double mechanical seals that are either carried out with a common single or double spring are not accepted. Any leakage passing the sealing shall not pass the bearings. Before it reaches the bearings the liquid shall create an alarm via the floating leakage sensor.

Metal parts shall be Type 316 or 316L stainless steel. Springs shall be Hastelloy C, Elgiloy, or other Duplex SS selected for resistance to chloride attack. Rotary faces shall be silicon carbide or chrome oxide.

1. Shaft seal: Pump side – Corrosion resistant tungsten carbide WCCR or corrosion resistant silicon carbide.
2. Shaft seal – Motor side – Corrosion resistant tungsten carbide WCCR.

Elastomers shall be ethylene propylene or fluorocarbon. Mechanical seals shall be suitable for operation between full vacuum (0 psia) up to 200 percent of the maximum specified operating pressure, but in any event not less than 200 psig.

Seal chambers shall be provided with vented solids removal restriction bushings except for enclosed line shaft pumps where the seal barrier fluid is used for line shaft bearing lubrication. The bushing shall both control the amount of flushing water flow and restrict solids and gas accumulation from the seal face area.

Candidate seals include:

1. Chesterton 442 seals provided with Chesterton/SpiralTrac solids removal restriction bushings Version N or D, as recommended by EnviroSeal Engineering Products, Ltd, Nova Scotia, Canada.

2. AESSEAL RDS seals with Cyclops bushing.

3. John Crane 3710 seals with Type 24SL bushing.

4. John Crane 5610 seals

Seals on pumps for contaminated water service (sludge or polymer) shall be drilled and tapped for connection of a clean water flushing supply.

C. SHAFT PACKING (NOT USED)

2.05 COUPLINGS

The impeller shall be mounted on the motor shaft. Couplings or gear boxes shall not be accepted.

2.06 GUARDS (NOT USED)

2.07 CAUTION SIGNS

Equipment with guarded moving parts which operates automatically or by remote control shall be identified by signs reading "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME". Signs shall be constructed of fiberglass material, minimum 1/8 inch thick, rigid, suitable for post mounting. Letters shall be white on a red background. The sign size and pattern shall be as shown on the drawings. Signs shall be installed near guarded moving parts.

2.08 GAGE TAPS, TEST PLUGS AND GAGES

No gage taps shall be provided to pumping equipment. Instead, gage taps shall be provided on the suction and discharge sides of pumps. Pressure and vacuum gages shall be provided where specified.

2.09 NAMEPLATES

Nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved or stamped stainless steel and fastened to the equipment in an accessible and visible location with stainless steel screws or drive pins.

2.10 LUBRICANTS

The Contractor shall provide for each item of mechanical equipment a supply of the required lubricant adequate to last through the specified commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the County's current lubricant supplier. The Contractor shall limit the various types of lubricants by

consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment (Section 01660), the Contractor shall provide the County with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

2.11 ANCHOR BOLTS

Anchor bolts shall be designed for lateral forces for both pullout and shear in accordance with the provisions of Section 05501. Unless otherwise stated in the individual equipment specifications, anchor bolt materials shall conform to the provisions of Section 05501.

2.12 SPARE PARTS

Spare parts, wherever required by detailed specification sections, shall be stored in accordance with the provisions of this paragraph. Spare parts shall be tagged by project equipment number and identified by part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration, such as ferrous metal items and electrical components, shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with a hinged wooden cover and locking hasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the underside of the cover.

PART 3 EXECUTION

Installation of equipment accessories included in this section shall be as recommended by the equipment manufacturer unless otherwise specified in the individual equipment specification section.

END OF SECTION

SECTION 11002 RIGID EQUIPMENT MOUNTS

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies minimum requirements for rigid equipment mounts (baseplates and mounting blocks) and their installation on equipment pads. Completed equipment supports shall consist of equipment pads, equipment anchors, and rigid equipment mounts (baseplates or mounting blocks) set in grout.

Unless alternate requirements for equipment mounts are specified in the applicable equipment specification, the requirements of this section shall be applied to rigid mounts for all rotating or reciprocating equipment that is used to mix, convey, or pressurize fluids. The requirements of this section shall also apply whenever referenced in specifications for other types of equipment. If conflict exists between this section and requirements of individual equipment manufacturers, the more restrictive requirements shall prevail.

B. DEFINITIONS:

Specific equipment mounting terminology used in this section conforms to the following definitions:

1. Baseplate: Fabricated (welded structural steel elements), cast, or plate steel base providing a common mounting element on which the legs, feet, or mounting surfaces of equipment are mounted by means of bolted connections.

2. Mounting Blocks: Multiple smaller baseplates on which individual legs, feet or equipment supports are mounted when equipment or drivers are not fastened to a common baseplate or sole plate.

3. Equipment Pad: Concrete foundation (block or slab) supporting and elevating equipment mounts above the supporting structural floor slab or local grade.

4. Mounting Pads: Thickened or raised areas of baseplates where the feet or mounting surfaces of mounted equipment and drivers are bolted and/or doweled to the baseplate or soleplate.

5. Leveling Blocks: Temporary steel blocks placed under baseplates, , or a mounting block at leveling positions (at equipment anchors) for the purpose of leveling baseplates or mounting blocks prior to grouting.

6. Shims: Thin stainless-steel plates of a uniform thickness installed on top of Leveling Blocks for fine adjustment of level. Shims may also be used between equipment or drivers and baseplates or mounting blocks for equipment alignment purposes.

7. Wedges: Pairs of uniformly tapered metal blocks that are stacked with the tapered surfaces reversed (relative to the other wedge) so that the top and bottom surfaces of the wedges are parallel. Wedges are used between equipment pads and baseplates or mounting blocks for the purpose of leveling baseplates or mounting blocks.

8. Mounting Stud: Threaded rod or bolts anchored to baseplates or mounting blocks for the purpose of mounting equipment or ancillary devices onto baseplates or mounting blocks.

9. Reinforcement Dowels: Steel reinforcement rods embedded in concrete, across a cold joint, for the purpose of transferring loads or force across thejoint.

10. Machine Alignment Dowels: Tapered diameter rods inserted in tapered diameter holes for the purpose of aligning machinery. The practice of drilling tapered diameter holes through machinery and baseplates so that Machine Alignment Dowels may be inserted to facilitate alignment of machinery is known as Doweling.

11. Leveling Position: A location on the top of a concrete equipment pad where leveling tools and equipment will be temporarily installed or used for the purpose of leveling baseplates and mounting blocks prior to grouting.

13. Grout Manufacturer: Refers to the manufacturer of the epoxy grout system used for installation of rigid equipment mounts.

14. Grout Manufacturer's Technical Representative(s): Refers to the technical representative(s) of the Grout Manufacturer.

C. EQUIPMENT MOUNTING REQUIREMENTS:

Unless otherwise specified, equipment and drivers shall be rigidly mounted on a common cast iron or fabricated steel baseplate grouted into place on a concrete equipment pad. Under no circumstances shall baseplates or mounting blocks be grouted directly to concrete slabs or floors. Equipment that uses an interdependent equipment and driver mounting configuration (equipment that is bolted onto the driver frame and equipment that supports the driver entirely from the equipment frame) may be bolted directly on concrete or grout surfaces of equipment pads if the driver is less than five horsepower. Bolting equipment directly on concrete or grout surfaces of equipment pads is not acceptable for equipment and drivers that do not have an interdependent equipment and driver mounting configuration.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed document, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean

the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/HI 1.4	Centrifugal Pumps – Installation, Operation and Maintenance
ANSI/HI 2.4	Vertical Pumps – Installation, Operation and Maintenance
API RECOMMENDED PRACTICE 686	Recommended Practices for Machinery Installation and Installation Design
ASTM E329	Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
MIL-PRF-907E	Anti-Seize Thread Compound, High Temperature
SSPC	Society for Protective Coatings Specifications, Vol. 2
IBC	2001 International Building Code (including local amendments)

B. QUALITY CONTROL BY CONTRACTOR:

To demonstrate conformance with the specified requirements for rigid equipment mounts, the Contractor shall provide the services of an independent testing laboratory that complies with the requirements of ASTM E329. The testing laboratory shall sample, and test equipment mount related materials as indicated in this Section (11002). Costs of testing laboratory services shall be borne by the Contractor.

For equipment with drivers 20 horsepower and greater, the Contractor shall have certification and be factory trained by the grout manufacturer. The grout manufacturer's technical representative shall perform training and quality control of epoxy grout installation for rigid equipment mounts as indicated in this section (11002).

1.03 SUBMITTALS

The following information shall be provided in accordance with the submittal requirements specified in Section 01300.

1. A copy of this specification section, with addendum updates included, (referenced sections need not be included for Section 11002) 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, referenced to a detailed written explanation of the reasons for

requesting the deviation. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration. Copies of this specification section shall be numbered and marked (specification number and equipment number) for inclusion (filing) with the associated equipment submittal requirements.

2. Schedule of rigid equipment mount installations specified in paragraph 11002-2.01.

3. Name, employer and certificates or other information documenting compliance with the journeyman qualifications requirements for millwrights who will install rigid equipment mounts, as specified in paragraph 11002-3.03. C.

4. Certificates or other documentation issued by the epoxy grout manufacturer that demonstrates that the grout manufacturer's technical representative has been factory trained on installation of epoxy grout for equipment mounts, as specified in paragraph 11002-1.02 B. 2.

5. Shop drawings for all equipment pads, equipment anchors, and baseplate, or mounting block details. Shop drawings shall depict size and location of equipment pads and reinforcement; equipment drains; equipment anchor, size, location, and projection; expansion joint locations; elevation of top of grout and grout thickness; elevation of top of baseplate; or mounting block; size and location of electrical conduits; and any other equipment mounting features embedded in equipment pads. Shop drawings for equipment pads, equipment anchors, and baseplate or mounting blocks shall be numbered and marked (specification number and equipment number) for inclusion (filing) with the associated equipment submittal requirements.

PART 2 PRODUCTS

2.01 GENERAL

Prior to initiating any installation efforts, the Contractor shall produce a rigid equipment mount installation schedule containing the expected dates for installing equipment anchors and preparation of equipment pads for leveling, grouting, and final equipment anchor clamping for each item of equipment. The schedule shall list the equipment, by equipment tag number, and shall list applicable equipment specification section, motor horsepower, and name of the Contractor's representative responsible for quality control during installation of rigid equipment mounts. The schedule shall be accompanied by written verification of equipment anchor clamping torque from the manufacturer of each item of equipment to be installed with rigid equipment mounts.

2.02 CONCRETE EQUIPMENT PADS

Concrete equipment pads or concrete mounting piers shall be as shown in the structural details for equipment pads and equipment anchors for rigid mounted equipment.

The Contractor shall submit equipment anchor calculations from the manufacturer for all equipment with drivers 20 horsepower and greater. Equipment anchor calculations shall demonstrate that equipment anchor size, embedment, and edge distance comply with the

Florida Building Code and are sufficient to resist the maximum lateral and vertical forces specified in paragraph 11000-2.11. Equipment anchor calculations shall be sealed by a registered structural or civil engineer licensed in the State of Florida.

2.03 BASEPLATES AND MOUNTING BLOCKS

A. GENERAL

Unless otherwise specified, Type I baseplates and mounting blocks shall be a minimum of 1 inch thick for equipment with drivers 20 horsepower and larger.

Type I baseplates and mounting blocks shall have edges of surfaces bearing on grout rounded to a radius of not less than 0.25 inch. Horizontal corners of Type I baseplates or mounting blocks shall be rounded to a radius of not less than two inches to avoid producing stress risers on the grouted foundation. Grout pouring holes (minimum 4 inches in diameter for epoxy grout, minimum 2 ½ inches in diameter for cementitious nonshrink grout) shall be provided in all baseplates and all baseplates shall have grout release holes. Mounting blocks may be grouted without grout pouring holes provided that no dimension of the mounting block (width or length) exceeds 18 inches. Grout relief or vent holes (minimum 1 inch in diameter) shall be provided in all baseplates and mounting blocks. Internal stiffeners shall be provided on all cast and fabricated baseplates and shall be designed to allow free flow of grout from one section of the baseplate to another. The minimum acceptable opening in cross bracing and stiffeners shall be 2-inches high by 6-inches in width. All welds shall be continuous and free from skips, blowholes, laps and pockets.

Mounting holes for equipment anchors shall be drilled through baseplates and mounting blocks. Mounting holes for equipment anchors shall not be burned out and they shall not be open slots. All mounting studs shall be Type 316 stainless steel. An anti-seize or anti-galling compound, as specified in paragraph 11002-2.06, shall be applied to all mounting stud threads prior to installing nuts on mounting studs. Terminations requiring connections to baseplates or mounting blocks shall be acorn nuts welded to the under side of the baseplate or nuts welded to the underside of the baseplate and plugged with cork, plastic plugs or grease. In no case shall the fastener terminate only into the metal base. Where baseplates or mounting blocks are leveled using jackscrews, jackscrew threads shall be tapped in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.

Mounting pads for equipment shall be machined after all welding and stress relieving and shall be coplanar within 0.002 inch per foot in all directions. Mounting pads shall extend not less than 0.5 inch beyond the perimeter of the foot or mounting surface of the mounted equipment, in any direction.

Equipment baseplates shall provide common support for the equipment and driver (and flywheel, if one is specified). Baseplates for equipment with drivers 20 horsepower and greater shall be furnished with eight transverse alignment (horizontal) positioning jackscrews for alignment of equipment drivers on horizontal surfaces of baseplates. Two of the eight transverse alignment/positioning jackscrews shall be installed in perpendicular directions in a horizontal plane at the mounting position for each corner or foot of the equipment driver. (Eight additional jackscrews shall be provided for transverse alignment of the flywheel, if flywheels are specified.)

B. TYPE I BASEPLATES

Type I baseplates shall be plate or fabricated structural steel baseplates with thickened steel mounting pads for doweling and bolting equipment to the baseplate. The baseplates shall be rectangular in shape for equipment other than centrifugal refrigeration machines and pump baseplates, which may be "T" or "L" shaped to accommodate the equipment drive and accessories. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the baseplate. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer.

C. TYPE II/III BASEPLATES (NOT USED)

D. TYPE IV BASEPLATES

Type IV baseplates shall be cast iron with thickened mounting pads for doweling and bolting equipment to the baseplate. Cast iron baseplates shall be sealed in accordance with the requirements for bleeding surfaces specified in prior to grouting.

E. MOUNTING BLOCKS

Where equipment is fabricated or cast with feet or mounting surfaces that are not fastened to a common baseplate, as in dry-pit bottom suction pumps, the equipment may be supported on individual concrete piers or equipment pads in lieu of a common baseplate and equipment pad. In such instances, the equipment shall be supported at the feet or mounting surfaces on individual mounting blocks, which shall be leveled and grouted into place on the individual piers or equipment pads as specified in this section. Vertical volute-type pumps weighing more than 2000 pounds shall be mounted on mounting blocks under each foot or mounting surface for the pump. All mounting blocks shall be furnished with jackscrew threads (three locations, minimum) tapped in the mounting block for the purpose of leveling mounting blocks with jackscrews.

2.04 GROUT FOR EQUIPMENT PADS

A. EPOXY GROUT FOR EQUIPMENT MOUNTING:

Unless otherwise specified, grout for setting bearing surfaces of baseplates and mounting blocks on equipment pads shall be Epoxy Grout for Equipment Mounting as specified in Section 03600. Where the term epoxy grout is used in the context of details and specifications for equipment mounting it shall mean Epoxy Grout for Equipment Mounting.

B. CEMENTITIOUS NONSHRINK GROUT:

Cementitious Nonshrink Grout, specified in Section 03300, may be used for setting bearing surfaces of baseplates or mounting blocks on equipment pads where equipment drivers are 20 horsepower and smaller and the combined weight of equipment and driver is less than 1000 pounds. Where the term nonshrink grout or cementitious grout is used in the context of details and specifications for equipment mounting it shall mean Cementitious Nonshrink Grout. Training and quality control by the grout manufacturer's technical representative is not required for rigid equipment mounts installed with cementitious non-shrink grout.

2.05 EPOXY PRIMER

Epoxy primer shall be a lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout. The epoxy primer shall be a product of the epoxy grout manufacturer.

2.06 ANTI-SEIZE/ANTI-GALLING COMPOUND

Anti-seize or anti-galling compound shall be a molybdenum disulfide and graphite combination in an aluminum complex base grease conforming to MIL-PRF-907E. Acceptable products include Jet Lube 550 by Jet Lube, Inc., E-Z Break by LA-CO, or equal.

2.07 PRODUCT DATA

The following information shall be provided in accordance with the product data requirements specified in Section 01300:

1. Equipment anchor calculations specified in paragraph 11002-2.02.

2. Results of grout strength tests, as specified in paragraph 11002-3.03 D.

3. Completed Rigid Equipment Mount Installation Inspection Checklist Forms (11002-A), as specified in paragraph 11002-3.02 B.

4. List of Contractor's equipment installation staff that has completed epoxy grout manufacturer's grout installation training specified in paragraph 11002-3.02 A.

PART 3 EXECUTION

3.01 GENERAL

Grouting for installation of equipment on equipment pads shall take place prior to connecting any field piping or electrical and instrumentation systems. Unless the County accepts an alternate installation procedure in writing, baseplates and mounting blocks shall be leveled and grouted with the equipment removed. Pumps shall be installed in accordance with this section and ANSI/HI 1.4 or ANSI/HI 2.4, as appropriate for the type of pumping equipment installed.

Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system without imposing strain on the equipment connections.

Where an equipment manufacturer's installation requirements include a rigid connection between the machine and connecting piping systems, the Contractor shall delete any flexible coupling (including equipment connection fittings) shown on the drawings and install the equipment in the following manner, in lieu of installing the flexible coupling:

1. The equipment pad shall be prepared as shown on the details for rigid equipment mounts

2. The baseplate or mounting blocks supporting the equipment shall be installed, leveled, and grouted in place as specified in this section.

3. The equipment shall be installed, aligned and doweled in place.

4. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding one of the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure tested.

5. All piping shall be fully supported by supports designed to accept their full weight and thrust forces.

6. The final sections of piping shall be aligned with the equipment and field connections without the use of jacks, chain falls or other devices to force it into alignment.

7. The final piping joints shall be welded only after the previous steps have been completed and accepted by the County.

3.02 EPOXY GROUT TRAINING AND QUALITY CONTROL

A. EPOXY GROUT TRAINING

Prior to commencing rigid equipment mount installation work on equipment pads, the Contractor shall furnish the services of a grout manufacturer's technical representative to conduct a training school for the workers that will be using the epoxy grout for rigid equipment mount installations. The school shall be not less than 4 hours in length and shall cover all aspects of using the products, from mixing to application. This requirement, however, shall not be construed as relieving the Contractor of overall responsibility for this portion of the work. The epoxy grout manufacturer shall furnish a list of school attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

B. EPOXY GROUT QUALITY CONTROL

For equipment with drivers 20 horsepower and greater, the epoxy grout manufacturer's technical representative shall provide quality control services for epoxy grout installation in rigid equipment mounts. The epoxy grout manufacturer's technical representative shall be on site to inspect and verify that the application personnel have successfully performed surface preparation, epoxy grout application, and Quality Control Inspection in accordance with these specifications for a representative portion of the epoxy grout installation work.

Specifically, the epoxy grout manufacturer's technical representative shall perform the following services for at least one rigid equipment mount installation for each equipment type and size:

1. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer's requirements.

2. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria, including but not limited to substrate profile, degree of cleanliness, and moisture.

3. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.

4. Inspect the epoxy-primed metallic substrate for coverage and adhesion.

5. Inspect preparation and application of epoxy grout form work for conformance to the specifications.

6. Inspect and record that the "pot life" of epoxy grout materials is not exceeded during installation.

7. Inspect epoxy grout for cure.

8. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.

9. Conduct a final review of completed epoxy grout installation for conformance to these specifications.

10. Attest to conformance of the Contractor's work by signing appropriate entries in the "Rigid Equipment Mount Inspection Checklist," form 11002-A in Section 01999.

3.03 INSTALLATION

A. CONCRETE EQUIPMENT PAD PREPARATION

After the concrete is fully cured, the top of the equipment pad shall be roughened by chipping the surface. Chipping shall remove all laitance and defective or weak concrete and result in a rough surface profile with a 0.25 inch minimum amplitude. Chipping shall expose broken aggregate without dislodging unbroken aggregate from the cement matrix and shall not cause fractures below the concrete surface. Leveling surfaces of the concrete that have been finished smooth and level for baseplate or mounting block leveling at equipment anchors shall be protected from damage during chipping. A light duty, hand held pneumatic chipper with a chisel type tool shall be used for chipping the equipment pad concrete surface. Abrasive blast, bush-hammer, jack hammers with sharp chisels, heavy chipping tools, or needle gun preparation of concrete surfaces to be grouted is not acceptable.

Prior to leveling activities, satisfactory removal of defective or weak concrete shall be demonstrated in the presence of the County by operating the chipper on the chipped concrete surface at locations identified by the County. The chipped surface of the concrete shall be such that the final baseplate or mounting block elevation results in the grout manufacturer's recommended grout thickness between the surface of the equipment pad and the lower baseplate flange or underside of mounting block.

All dust, dirt, chips, oil, water, and any other contaminants shall be removed and the surface protected with plastic sheeting until grout is installed.

Concrete equipment pad surfaces that have been finished smooth and level for use as leveling positions shall be protected from damage during chipping activities. Alternatively, leveling positions may be restored on chipped surfaces. Leveling positions shall be restored by installing leveling blocks or leveling plates for jackscrews on a high compressive strength epoxy putty (Philadelphia Resins, Phillybond Blue 6A, or equal). Leveling blocks and leveling plates shall be installed level on the epoxy putty.

B. BASEPLATES AND MOUNTING BLOCKS

All surfaces of baseplates and mounting blocks to be in contact with epoxy grout shall be cleaned to SSPC SP-6 and shall be primed with epoxy primer within 8 hours of cleaning.

C. LEVELING

All machinery shall be mounted and leveled by journeyman millwrights. Precision surveying equipment shall be used for leveling. Machinists' spirit levels will not be permitted for leveling purposes for any baseplate or mounting block with a plan dimension greater than 4 feet. Baseplates and mounting blocks shall be leveled to a maximum tolerance of 0.002 inch per foot or as otherwise required by the equipment manufacturer, if more stringent. An anti-seize or anti-galling compound specified in paragraph 11002-2.06 shall be applied to all equipment anchor threads prior to beginning baseplate or mounting block leveling.

All baseplates and mounting blocks shall be leveled against steel surfaces (jackscrew plates, leveling blocks, leveling nuts, support plates, or other steel surfaces). Use of other materials for leveling purposes is strictly and specifically prohibited. Unless otherwise specified, baseplates and mounting blocks shall be leveled as indicated in the leveling details. Leveling equipment and tools shall be stainless steel leveling blocks and shims, steel wedges, or jackscrews bearing on leveling plates. Leveling nuts may be used for leveling baseplates weighing less than 200 pounds. The use of leveling nuts for leveling mounting blocks is not permitted.

After baseplates or mounting blocks have been leveled on the leveling equipment, the Contractor shall clamp the baseplates or mounting blocks in position by installing the equipment anchor nuts and washers. Clamping torque shall be less than the final clamping torque specified in paragraph 11002-2.01, but sufficient to hold the baseplate or mounting block in position. The Contractor shall verify that the correct level and position of the baseplate or mounting block has been maintained after clamping on the leveling equipment.

Leveling blocks shall be stainless steel, four inches square and 1-1/2 inches thick with an open-ended slot terminating in the center for the equipment anchor. Leveling blocks shall be machined flat on all horizontal surfaces and placed under the baseplate at each equipment anchor. Shims shall be pre-cut stainless steel, slotted for removal after grouting, and shall extend not less than three inches beyond the baseplate or mounting block. Leveling blocks and shims shall be coated with a light oil just prior to beginning the leveling and grouting work. Shims shall be placed so the tabs on the shims are easily accessible.

D. GROUTING

Grout forms shall be built of minimum 0.75-inch-thick waterproof plywood and shall be securely braced (minimum brace size shall be two-by-four lumber). Forms shall be designed for a minimum of 6 inches hydrostatic head above the final elevation of the grout, to assist in flow during installation. Equipment mounting grout shall be furnished with expansion joints installed at four to six foot intervals, perpendicular to the centerline of baseplates.

Forms shall be coated with three coats of paste wax on all areas that will come in contact with the grout to prevent the grout from bonding to the forms. Forms shall be waxed before assembly to prevent accidental application of wax to surfaces where the grout is to bond. Before any forms are installed, all concrete surfaces that will contact epoxy grout shall be free from any foreign material, such as oil, sand, water, wax, grease, etc. Forms shall be liquid-tight. Any open spaces or cracks in forms, or at the joint between forms and the foundation, shall be sealed off, using sealant, putty, or caulking compound. All outside vertical and horizontal edges of the grout shall have 45-degree chamfers as indicated in the equipment anchor details for rigid equipment mounts. Match chamfers in concrete portions of the equipment pad. Block outs shall be provided at all shimming and leveling positions to allow removal of leveling equipment and tools after the grout has cured. Jackscrews shall be coated with a light oil or other acceptable bond-breaking compound prior to grouting.

The 45-degree perimeter chamfer strip shall be located at the final elevation of the grout. The final elevation of the grout on baseplates with exposed I-beam or C-channel supports shall be at the top of the lower support flange. The top of the grout, on all other baseplates and mounting blocks, shall be at least 1.0 inch above the bottom or underside of the baseplate or mounting block and shall not be higher than the top of the baseplate or mounting block. The grout's final elevation shall not be so high as to bond the equipment anchor nut and washer.

The resin and hardener for epoxy grout for equipment mounting shall be mixed in accordance with the epoxy grout manufacturer's recommendations. Epoxy grout shall be placed at the center of one end of the baseplate and worked toward the ends in such a manner as to force the air out from beneath the baseplate and out the vent holes, to eliminate voids. Epoxy grout shall be placed in a manner that avoids air entrapment, using a head box to pour grout into the grout holes. When the head box is moved to the next grout hole, a 6-inch high standpipe shall be placed over the grout hole and filled with grout. Use of vibrating tools and/or jarring (rapping or tapping) forms to facilitate grout flow is not permitted during placement of epoxy grout.

The Contractor shall exercise care to never allow the grout to fall below the baseplate level once the grout has made contact with the baseplate. Grout placement shall be continuous until all portions of the space beneath the baseplate or mounting block have been filled. Subsequent batches of grout shall be prepared so as to be ready when the preceding batch has been placed. Under no circumstances shall the grouting operation be halted because of lack of grout mix. After the entire baseplate is full, 6-inch high standpipes shall be maintained over each grout hole, to continue purging of air. When the grout has started to take an initial set (typically this is determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.

Where the cavity under a baseplate or mounting block extends above the elevation of

the top of the bolting flange for the baseplate or mounting block, grouting may be completed in two pours. Under these circumstances, the first grout pour shall be continuous until the lower face of the bolting flange for the baseplate or mounting block is submerged in grout a minimum of one inch. The second grout pour shall be completed with standpipes and air purges as specified in the previous paragraph.

Grout forms shall be checked for leaks throughout grout pours. Leaks shall be repaired immediately to prevent formation of voids. A final check of baseplate or mounting block level and elevation shall be performed before the grout sets.

A grout sample shall be taken for each equipment pad that has a baseplate or mounting block set in grout. The sample shall be placed in a cylinder of sufficient size to yield three two-inch cubes as test samples. The samples shall be tagged with project name, date, time, the equipment number and ambient temperature at the time of placement. Once the epoxy grout cylinder has been completely filled, it shall be placed next to the foundation of the equipment being grouted and allowed to cure for 48 hours. After 48 hours, the test cylinder shall be tested in accordance with the grout manufacturer's recommendations by the independent testing laboratory specified in paragraph 11002-1.02 B. The results shall be reported directly to the County. Forms shall be removed only after the grout has cured sufficiently and upon specific permission from the County.

E. COMPLETION

Upon acceptance by the County and the equipment manufacturer's representative and after the grout has reached sufficient strength, grout forms and block outs at leveling positions shall be removed. Leveling blocks and shims or wedges and support plates shall be removed, leveling nuts and jack screws shall be backed off to allow the grout to fully support the baseplate, mounting block, or soleplate. Take care not to damage the grout during removal of extended shimming material or leveling equipment and tools.

The equipment anchor nuts shall be tightened, using calibrated indicating torque wrenches, to develop the full clamping force required by the equipment manufacturer.

Equipment anchor nuts shall be tightened in increments of not more than 25 percent of the final torque value in an alternating pattern to avoid stress concentration on the grout surface. After tightening equipment anchor nuts to final values, apply additional wax, grease, or mastic to all exposed portions of the equipment anchor beneath the baseplate, soleplate, or mounting block.

After applying additional wax or mastic to exposed portions of equipment anchors, block outs (pockets) for access to leveling nuts, leveling blocks and shims, or wedges shall be filled with the grout material installed under baseplates or mounting blocks and pointed after the equipment anchor nuts have been tightened to final values. Jackscrews shall be removed and holes in the baseplate or mounting blocks filled with a flexible sealant (silicone rubber) or a short cap screw.

Check for baseplate or mounting block movement (soft foot) by individually loosening and re-tightening each equipment anchor. Vertical movement at each equipment anchor shall be measured and recorded during loosening and retightening and shall not exceed 20 micrometers (0.001 inch). Vertical movement shall be measured using a magnetic-based dial indicator on the baseplate or mounting block referenced to the epoxy grout surface of the equipment pad or other approved method. Soft foot

conditions shall be sufficient cause for removal and reinstallation of grout and baseplates or mounting blocks.

Check for grout voids by tapping along the upper surfaces of the baseplate or mounting block. Grout voids shall be sufficient cause for removal and reinstallation of grout and baseplates or mounting blocks. Grout voids shall be marked. At the discretion of the County, grout voids may be repaired as specified in Chapter 5, Section 3.16 of API 686.

3.04 FINAL INSPECTION

The County will conduct a final inspection with the Contractor for conformance to requirements of the contract documents.

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SECTION 11050 GENERAL REQUIREMENTS FOR CENTRIFUGAL AND AXIAL FLOW PUMPING EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section, when referenced in the detailed specification section, provides minimum requirements applicable to centrifugal and axial flow pumping equipment furnished under this contract. More restrictive requirements, where found in individual pump specifications, shall supersede requirements of this section.

"Detailed pump specification", "detailed specification", "individual pump specification", "referencing section", or words of similar import in this section, shall mean the specification section where the requirements for specific pump performance are presented. "Pumping unit", whenever and wherever used, shall mean the complete pumping assembly, including driver (whether engine, turbine, or motor) and shall include all accessories such as variable speed drives required for motor operation, gear reducers, intermediate shafting and bearings, flywheels, and all supports for all equipment furnished with the pump.

A number of provisions of this section shall be required for a subset of pumps. These requirements (refer to Paragraphs 1.05 and 1.07.A, in this Section) are in addition to requirements applicable to all pumps. The subset of pumps is defined as pumping equipment meeting any of the following criteria:

1. All pumping unit specifications where the words "Custom Engineered" appear in the title of the specification section.

2. Where a particular Section 11050 provision is specifically cited in the detailed section.

B. DEFINITIONS:

The following definitions apply for classifying pumps specified in this and referencing sections:

1. GENERAL: Terminology and definitions in this Section follow those established in ANSI/HI 9.1 - 9.5, unless otherwise noted.

2. SOLIDS BEARING LIQUIDS: Liquids to be pumped containing, or assumed to contain, solids that require appropriate pump design considerations and/or materials of construction. Solids Bearing Liquids are liquids with settleable solids exceeding 50 mg/L and shall include wastewater, stormwater, primary effluent, return sludge, return activated sludge (RAS), trickling filter circulation, and similar services.

5. EFFICIENCY: For the purposes of this section and sections referencing this section, efficiency, as related to pumps, shall be the ratio of the pump output power (water horsepower) divided by the pump input power (brake horsepower) required

to deliver the total head, with meanings as defined in HI 1.2.3.8 and 2.2.3.8. For column type pumps, it shall be computed inclusive of inlet, bowl, column and discharge head losses.

6. NET POSITIVE SUCTION HEAD – 3 PERCENT REDUCTION (NPSH3): For the purposes of this section and sections referencing this section, NPSH3 shall mean the value of net positive suction head resulting in a reduction of 3 percent in the developed pump discharge head when the pump is tested in accordance with procedures established by the Hydraulic Institute. NPSH3 is the successor designation to NPSHR (net positive suction head required). Where NPSHR is used in the Contract Documents it shall be taken to mean NPSH3.

7. NPSH MARGIN: For the purposes of this section and sections referencing this section, "NPSH Margin" wherever used shall mean Net Positive Suction Head Available (NPSHA) divided by the candidate pump's Net Positive Suction Head-3 Percent Reduction (NPSH3) for the specific operating condition in question.

8. PACL: For the purpose of this section and sections referencing this section "PACL" Wherever used shall mean Pump Application Capacity Limits and is used in these specifications in lieu of the terms Preferred and Allowable Operating Region. PACL is defined in terms of percentage Best Efficiency Flow (BEPQ) to define the margins (based upon suction specific speed) that respectively identify the minimum and maximum flows defining acceptable performance regions for pumps covered by this specification section and any specification section referencing this section. Refer to paragraph 11050-1.04 B. 4.

1.02 TYPE

Provisions and requirements contained in this section apply specifically to centrifugal and axial flow pumps, both vertical and horizontal, commonly falling into the generic types covered by ANSI/HI 1.1 through 1.4 and 2.1 through 2.4. This section does not apply, except by specific reference, to positive displacement pumps of any type.

1.03 REFERENCES

This section (Section 11050) contains references to the following documents. They are a part of this section and any referencing section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section or any referencing section and those of the listed documents, the following order of precedence shall prevail (in the order of primacy):

1. The referencing section.
2. This section.
3. The referenced document.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
AISC	American Institute of Steel Construction –Manual of Practice
ANSI/API 610	Standard for Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
ANSI/ASME B46.1	Surface Texture, Surface Roughness, Waviness and Lay
ANSI/HI 1.1 – 1.4	Rotodynamic (Centrifugal) Pumps
ANSI/HI 2.1 – 2.4	Rotodynamic (Vertical) Pumps
ANSI/HI 9.1 – 9.5	Pumps – General Guidelines
ANSI/HI 9.6.2	Centrifugal and Vertical Pumps for Allowable Nozzle Loads
ANSI/HI 9.6.4	Centrifugal and Vertical Pumps. Vibration Measurements and Allowable Values
ANSI/HI 9.8	Pump Intake Design
ANSI/HI 11.6	Submersible Pump Tests
ANSI/HI 14.6	Rotodynamic Pumps for Hydraulic Performance Acceptance Tests
API 686/PIP REIE 686	Recommended Practices for Machinery Installation and Installation Design
ASME B18.8.2	Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)
ASME Code	ASME Boiler and Pressure Vessel Code
ASTM A27	Steel Castings, Carbon, for General Application
ASTM A36	Carbon Structural Steel
ASTM A148	Steel Castings, High Strength, for Structural Purposes
ASTM A322	Steel Bars, Alloy, Standard Grades
ASTM A564	Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A571	Austenitic Ductile Iron Castings for Pressure-Containing Parts Suitable for Low-Temperature Service
ASTM A995	Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts, Grades 2A, 3A, or 6A
ASTM B148	Aluminum-Bronze Sand Castings
AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

Reference	Title
AWWA C550	Protective Epoxy Coatings for Valves and Hydrants
NSF/ANSI 61	Drinking Water System Components – Health Effects
IEC 61298-2	Process Measurement and Control Devices. General Methods and Procedures for Evaluating Performance Tests Under Reference Conditions
ISO 9001	Quality Management Systems – Requirements, 3rd Ed. (2000)
ISO 10816-1	Mechanical Vibration—Evaluation of Machine Vibration by Measurement on Non-rotating Parts—Part 1: General Guidelines, Annex B, Table B.1. Zone A, Class I, II or II, as applicable. For the purposes of this specification, Annex B of ISO 10816, Part 1 shall form a part of this specification and ISO 10816, Part 1.
ISO 10816-7	Mechanical Vibration—Evaluation of Machine Vibration by Measurement on Non-rotating Parts—Part 7: Rotordynamic Pumps for Industrial Applications, Including Measurements on Rotating Shafts, Annex A, Tables A-1 and A-2 as applicable. For the purposes of this specification, Annex A of ISO 10816, Part 7 shall form a part of this specification and ISO 10816, Part 7.
MIL STD 167-2	Mechanical Vibrations of Shipboard Equipment (Reciprocating Machinery and Propulsion System and Shafting)
Corbo and Malanoski, 1996	Practical Design Against Torsional Vibration, 25th Turbomachinery Symposium, Turbomachinery Laboratory, Texas A & M University, p. 186 – 222
Corbo and Malanoski, 1998	Pump Rotordynamics Made Simple, Pumping Technology, June 1998, p. 202 – 236

1.04 DESIGN REQUIREMENTS – ALL PUMPS:

A. GENERAL

Equipment furnished under all sections referencing this section shall conform to the requirements and objectives of paragraph 6.1, ANSI/API 610, unless specifically stated in this and the detailed specification section. All components associated with the rotating elements in the drive train, including equipment supports and supports for rotating elements, shall be selected and designed to function without damage or disassembly at reverse rotational speeds up to 150 percent of maximum operational speed during flow reversals through the pump. The complete pumping unit shall operate without overload on any component at any point along the pump's entire full-speed operating curve. Pumps required by virtue of the specified operating conditions to operate against a closed valve or throttled for any period of time exceeding five seconds shall be furnished with drivers sized to operate continuously at the power requirement for that condition even though the power requirements at the rated condition may be less.

B. PUMP SELECTION

1. PROVEN DESIGNS: Pumps furnished under all sections referencing this section shall be proven designs that shall have been in service under similar conditions of service with no objectionable performance characteristics for a period of not less than five years. The Contractor shall furnish a detailed list, duly signed by an officer of the pump manufacturer's corporation and notarized, of installations with contact information supporting qualification under this requirement with the information required under paragraph 11050-1.08. In order to satisfy this requirement, listed pump shall be of the same size volute or bowl, discharge case and nozzle size, impeller design (including number of vanes) and shall be operating under similar conditions of pumped fluid, head, capacity, speed, rotation, and Net Positive Suction Head Available (NPSHA).

2. GENERAL PERFORMANCE CRITERIA: Pumps furnished under this section and any referencing section shall operate without loss of head due to cavitation or vibration over the entire specified range of flow and head conditions and shall be specifically selected for NPSH margin requirements detailed in paragraph 11050-1.04.F. Pump selections which do not provide the specified margin will be rejected.

3. GENERAL DESIGN CRITERIA: All pumps furnished under sections referencing this section shall be designed in accordance with applicable portions of ANSI/HI 1.1 – 1.4, 2.1 – 2.4 and ANSI/HI 9.6.2 – 9.6.6 and the requirements of this section. The pumps shall be specifically designed to pump the fluid described in the detailed specification and shall operate without clogging or fouling caused by material in the pumped fluid at any operating condition within the range of service specified.

Unless otherwise noted or specified, pump head capacity curves shall slope in one continuous curve within the specified operating conditions. No points of reverse slope inflection capable of causing unstable operation will be permitted within the specified zone of continuous duty operation. Pumps with head/capacity curves with a reverse inflection are specifically prohibited if these characteristics will cause unstable operation within the specified range of operating conditions and where startup/shutdown conditions entail operation against a slow opening/closing valve.

Pumps specified to operate at variable speed shall function without loss of head due to cavitation or excessive vibration over the entire specified range of flow and head conditions defined by the region bounded by Condition Points A, B C, and D (Specification 11305) and any other continuous duty operating condition specified in the detailed specification referencing this section. The region shall be displayed as a cross-hatched area on a linear X-Y plot of the selected pump's variable speed performance curves plotted in 10 percent increments for the proposed maximum speed to the speed required to meet Operating Condition Point C or any other specified reduced speed operating condition, whichever is less. Unless otherwise specified in the section referencing this section, acceptance criteria shall include the following:

a. Operating Condition Points B and C shall reside within the region defined by the PACL limits set forth in this section for the proposed pump selection, based upon the pump's suction specific speed.

b. No more than 10 percent of the cross-hatched zone noted above shall reside outside the PACL limits set forth in this section for the proposed pump selection, based upon the pump's suction specific speed. Operating Condition A may reside in the area outside the PACL limits.

Pumps shall be shall be specifically selected for NPSH margin requirements detailed in paragraph 11050 1.04.F. Pump selections which do not provide the specified margin will be rejected.

4. PUMP APPLICATION CAPACITY LIMITS: (PACL): Condition Point A shall be the pump's rated maximum condition and shall be guaranteed to meet both specified head and flow within the limit established in ANSI/HI 14.6, acceptance grade 1U.

Typicall, a given pump's PACL shall be determined as a percentage of Best Efficiency Flow (BEPQ) at the given speed, the pump's suction specific speed as determined in accordance with ANSI/HI 1.3, paragraph 1.3.2.2. However, due to the application, a pump that operates within the PACL as determined by ANSI/HI 1.3 is not possible due to the head conditions. The pump manufacturer shall provide a signed statement, in which the manufacturer states that the selected pump is suitable for the application despite not meeting ANSI/HI 1.3 requirements for PACL County.

C. CRITICAL SPEEDS AND NATURAL FREQUENCIES (NOT USED)

1.

D. IMPELLER CLEARANCES, VANE PASSING FREQUENCY AND IMPELLER KEYWAYS

The radial clearance between the tip of the impeller vane and diffuser or volute vanes shall be not less than 3 percent and 6 percent, respectively, of impeller diameter. The ratio of liquid channel widths (diffuser or volute/impeller) shall be not less than 1.15 nor more than 1.3 for diffuser pumps and 1.4 – 1.5 for volute-type pumps. The pump shall be designed so that internal geometry shall not cause uneven flow distribution at impeller vane inlets.

E. COMPONENT DESIGN CRITERIA

1. GENERAL: Unless otherwise specified, combined stresses in steel frames and supports shall not exceed those permitted by the AISC Manual of Practice. Combined stresses in cast, forged, rolled, or fabricated pressure retaining components, frames and supports shall not exceed that allowed for the given material in Section VIII, Division 1 of the ASME Code. Design pressures for pressure-retaining parts shall be not less than twice the pump's shutoff head at the manufacturer's listed maximum operating speed. Pump casing strain at any head on the full speed operating curve (including allowances for increases caused by specified multi-stage applications) shall not result in distortions at the bearing housings greater than the maximum allowable by the bearing manufacturer to provide the specified bearing life.

The term "combined stresses" in this section shall mean the sum of all operating stresses, including stresses induced by dynamic and static forces as developed via the analysis procedures stipulated in this section. Static forces (x, y, z, and

moments in all planes) shall include the relevant maximum nozzle loads specified in ANSI/HI 9.6.2 or as stipulated by the pump manufacturer. Dynamic forces shall include both steady state and transient stresses induced by operating conditions within the zone of operation established by the specified operating conditions.

2. ANCHORAGE AND EQUIPMENT MOUNTS: The Contractor shall cause the pump manufacturer to be responsible for the design of the anchor bolting system and equipment supports for each separately mounted component furnished under the detailed specification. Anchorage and equipment support requirements for pumps shall conform to the requirements of Section 11002 and the standards of the Hydraulic Institute.

   Anchor bolts and connecting bolts for all pumps and assemblies supported by other assemblies furnished under this section, or sections referencing this section, shall be designed in accordance with Section 01900. All operation and maintenance manuals for all pumps and assemblies shall contain criteria for anchor and baseplate bolt torque values.

Unless otherwise recommended by the equipment manufacturer, all pump discharge nozzles shall be restrained using the equipment connection fitting shown in the Contract Drawings and specified in Section 02640.

Tapered dowel pins shall be used to record the final position of all machine bases on pump baseplates. Dowel pins shall be hardened and machine-ground conforming to the requirements of ANSI/ASME B18.8.2. Holes for tapered dowels shall conform to the requirements set forth in Appendix A of ANSI/HI B18.8.2.

3. TORSIONAL AND COMBINED SHAFT STRESSES: Shaft stresses shall be calculated using the following equation and the stress concentration factors in the table below.

$$S = S_{cf} \times \frac{G \times D \times \Delta_{\Theta}}{2 \times L}$$

where:

S	=	stress, psi
S_{cf}	=	stress concentration factor, dimensionless
D	=	minimum shaft diameter at point of concentration, inches
Δ_{Θ}	=	twist in shaft between adjacent masses, radians
L	=	effective length between masses, inches
G	=	shear modulus of shaft material, lb/in^2

The S_{cf}, to be applied at all the roots of all keyways and changes in shaft diameter shall be as follows:

S_{cf}	Ratio of fillet radius to shaft diameter
4.3	0.0025
3.7	0.01
3.05	0.02
2.75	0.03
2.6	0.04
2.55	0.05 and greater

Values of S_{cf} between data points in the table above shall be based upon a straight line interpolation.

4. SHAFT DEFLECTION: (NOT USED)

5. BEARINGS: Unless otherwise specified, anti-friction bearings for pumps shall be selected for a minimum L-10 life of 50,000 hours in accordance with ABMA 9 or 11. Anti-friction bearings for Custom Engineered pumps shall have bearings selected for an L-10 life of 100,000 hours in accordance with ABMA 9 or 11. Bearings for other elements in the rotating system such as motors and intermediate shaft bearings shall be selected using the same criteria as specified for the pump. Bearing selection shall be based upon the worst combination of continuous duty operating conditions specified and shall include both steady state and transient loads. Calculations supporting the selection of bearing sizes shall be provided as Product Data.

6. BEARING ISOLATORS: Unless otherwise specified, all pump and motor bearings shall be fitted with bearing isolators, specifically selected for the size and type bearing. Bearing isolators shall be labyrinth, non-fretting type designed to expel contaminants by centrifugal force and prevent escape of lubricants. Vapor block capability shall be provided. Bearing seals shall be Inpro/Seal or approved equal.

F. NET POSITIVE SUCTION HEAD MARGIN LIMITATIONS

1. GENERAL: Pumps furnished under this section and sections referencing this section shall be selected for NPSH (Net Positive Suction Head) margin limitations using the criteria set forth in this section. Net Positive Suction Head Required - 3 Percent Reduction (NPSH3) characteristics for the candidate pump shall be based upon documented test data not more than five years old, performed on a pump not more than two nominal pump diameters larger or smaller than the proposed pump with an impeller of the same geometry as that proposed for the pump to be used for the subject application, and operating at the same speed as the pump for the proposed application. The Contractor shall document the basis for pump selection based upon NPSH margin limitations as set forth in this paragraph.

The detailed specification sections provide NPSHA (Net Positive Suction Head Available) information for anticipated operating conditions for each application. This information is generally referenced to a specific elevation, stated in terms of project datum. It shall be the Contractor's responsibility to cause the pump manufacturer to adjust the NPSHA information in the specification section to the

elevation of the pump impeller eye for the specific pump model and size proposed for the application. NPSH3, as used in the following paragraphs, shall mean the NPSH3 at the impeller eye, determined in accordance with ANSI/HI 11.6 or 14.6, as applicable for the proposed pump. The Contractor shall cause the pump manufacturer to document the method used to determine NPSH3 for the proposed pump and justifying compliance with the NPSH margin limitations established under this paragraph for each specified operating condition in material submitted under paragraph 11050-1.08. The documentation shall include justification of the NPSH3 tests used to develop NPSH3 characteristics, including the following:

a. Date, test procedure, and test logs of original NPSH3 information used to project requirements for pump selected for the application.

b. Test pump size, impeller diameter, impeller model, eye diameter, and speed.

c. Calculations projecting NPSH3 test information to NPSH3 curve information for the pump proposed for the application.

d. Calculations demonstrating compliance with the NPSH margin requirements established in this paragraph.

The Contractor shall submit the manufacturer's margin calculations justifying the proposed pump selection with the material required under paragraph 11050-1.08. The NPSH margin ratios specified in this paragraph shall be the minimum acceptable margin ratios. If the proposed pump requires greater margin ratios to operate within the specified operating conditions without loss of head due to cavitation, then it shall be the responsibility of the Contractor to bear all costs associated with achieving the required margin ratio by lowering the elevation of the pump setting, lowering the elevation of the structure or other means. Any such adjustments shall be subject to review and acceptance by the County.

Individual restrictions that apply to NPSH margin shall be as set forth below, depending upon the type of pumping equipment and the fluid to be pumped.

2. CENTRIFUGAL PUMPS – WASTEWATER SERVICE (NOT USED)

3. CENTRIFUGAL PUMPS - CLEAR LIQUID SERVICE (NOT USED)

G. ELECTRIC MOTORS

1. GENERAL: Unless otherwise specified, pumps shall be electric motor driven. All motors shall be selected to be non-overloading at any operating point along the pump's full speed operating curve, including all points located beyond specified operating conditions. All vertical motors shall be solid shaft construction. Hollowshaft motors will not be accepted. Motors furnished with pumps specified for operation at variable speed shall be inverter duty types conforming to the requirements of Section 11060 and shall be compatible with the variable speed equipment furnished with the pump.

Motor bearings shall be protected with bearing isolators as specified in paragraph 11050-1.04.E.

2. BALANCE: Motors rated 50 horsepower and greater, and all motors operating at less than 1200 rpm shall be precision balanced motors conforming to the requirement set forth in the table below.

Speed, rpm	Mils displacement (peak to peak)
3000 and above	0.5
1500 - 2999	1.0
1000 - 1499	1.0
<1000	1.5

The Contractor shall provide certified balance logs attesting to achieving these requirements, as Product Data under paragraph 11050-2.09. Displacement readings shall be taken at the shaft with an FFT analyzer at 1X speed. Balance logs shall be notarized and signed

1.05 ADDITIONAL DESIGN REQUIREMENTS (NOT USED)

1.06 QUALITY ASSURANCE – ALL PUMPS

A. QUALITY CERTIFICATION

All manufacturers and manufacturing sites proposed by the Contractor for supply of equipment furnished under this section and sections referencing this section shall hold current certification under ISO 9001. Application for certification under ISO 9001 shall not be deemed as an acceptable substitute for current certification. Documentation attesting to current certification shall be signed by an officer of the manufacturer's corporation and shall be notarized. The documentation shall also include the manufacturer's written Quality Assurance/Quality Confirmation (QA/QC) program and the documentation plan necessary for ISO 9001 certification.

B. UNIT RESPONSIBILITY

The Contractor shall assign Unit Responsibility to the pump manufacturer in conformance with the requirements of Section 11000.

C. PERFORMANCE CONFIRMATION

1. HYDROSTATIC TESTS: All pressure sustaining parts shall be subjected to factory hydrostatic tests. Hydrostatic tests shall conform to the requirements of paragraph 8.3.2 of ANSI/ ANSI/API 610. Castings shall be held at the test pressure for 30 minutes. Test results shall be certified correct by an officer of the pump manufacturer's corporation, and shall be notarized.

2. PERFORMANCE GUARANTEE: Unless specified otherwise in the detailed specification, pump performance (flow and head, efficiency and NPSH3) shall be guaranteed by the pump manufacturer to the criteria specified under this paragraph.

Equipment performance documentation, including test data, where tests are specified, shall include sufficient test points (not less than 8) to document hydraulic performance along the complete head/capacity curve from shutoff to maximum capacity and shall cover all full speed operating points specified in the detailed specification section referencing this Section. Tests conducted at specified operating conditions shall be the inlet throttled to product the NPSHA indicated for that specific condition in the detailed specification. NPSH3 tests shall be performed for not less than four full speed operating conditions, but not less than all specified operating conditions and at Best Efficiency.

Test procedures shall conform to those set forth in ANSI/HI 14.6 acceptance grade 1U, and as specifically detailed in these specifications. Performance tests shall be conducted at the specified maximum speed. Affinity relationship-predicted test results will not be accepted.

Acceptance criteria for head and capacity test results, based upon the rated condition specified in the detailed specification shall be as required in ANSI/HI 11.6 and 14.6, acceptance grade 1U.

Acceptance criteria for NPSH3 at any specified operating condition shall be the values proposed by the Contractor in the submittal curves submitted under paragraph 11050-1.08 and duly accepted by the County, with a tolerance of plus 0, minus unlimited, with the exception that suction specific speed, as calculated for the specific pump, shall not exceed the limitation established under paragraph 11050-1.04.B.

The guarantee shall include a statement to the effect that the pump will operate within the operating regions specified in the detailed specification. The guarantee shall be in writing, shall be signed by an officer of the manufacturing corporation, and shall be notarized. Under no circumstances shall deviations from specified operating conditions result in overload of the driver furnished with the equipment, nor shall such deviations result in power requirements greater than the driver's nameplate (1.0 service factor) rating.

3. NON-WITNESSED TESTS: Unless specified otherwise, all pumps shall be performance tested in accordance with ANSI/HI 14.6, Acceptance Grade 1U. The factory tests shall include test data for each full speed performance requirement (Condition Points A, B, C, and D specified in the detailed specification) and any other points stipulated for this test procedure in the detailed specification. These tests shall be conducted with the pump inlet throttled to provide the specified NPSHA. If specified in the detailed specification, test data at the full speed operating conditions shall include shaft vibration and case noise.

The test setup in the manufacturer's test facility shall duplicate as closely as possible the inlet conditions in the proposed installation, using temporary baffles and other means. Where centrifugal pumps are furnished with inlet elbows, inlet adapters or inlet reducers, the pumps shall be tested with the elbow, adapter or reducer fitted to the pump and specified performance criteria shall apply to the complete pump assembly, including losses through any elbow, adapter or reducer. The specified performance requirements shall apply to the complete pumping assembly including any inlet nozzles, and discharge elbows or adapters. Certified

test data shall include separate readings for inlet and discharge head for each data point.

Not less than eight test points shall be taken, including not less than three within ± eight percent (in terms of rated flow) of the rated condition (Condition Point A) and not less than two test points within ±4 percent of the pump's best efficiency point at the test speed. In addition, one test point shall be sufficient to define head and power requirements at shutoff head.

NPSH3 tests shall be performed to confirm the data used to establish NPSHA margin for each specified operating condition as specified in paragraph 11050-1.04.F. NPSH3 tests for column type (axial and mixed flow and vertical turbine) pumps shall be performed using the method described for Figure 2.74 or Figure 2.75 in ANSI/HI 2.6. NPSH3 tests for submersible wastewater pumps shall be performed using the method described in Figure 11.6.8 in ANSI/HI 11.6. All NPSH3 tests shall extend from 30 percent to 140 percent of Best Efficiency Flow at full speed, or to not less than 10 percent (in terms of flow) past the flow at Operating Condition B, whichever is greater. Failure to achieve specified performance or performance proposed in accepted submittal documents (capacity and head, efficiency or NPSH3), whichever is more restrictive, shall be cause for rejection. Acceptance tolerances shall be as set forth in paragraph 11050-1.06.C.2.

All test procedures shall be in strict conformance with the referenced standards, except prediction of performance of a trimmed impeller from test data of the larger impeller will not be permitted. If trimming is required, the pump shall be retested. Under no circumstances shall deviations from specified operating conditions, though allowed by the referenced standards, result in overload of the driver furnished with the equipment, nor shall such deviations result in power requirements greater than the driver's nameplate (1.0 service factor) rating.

The Contractor shall furnish the County with not less than two weeks' advance written notice of the date and place of the non-witnessed tests.

All test results, including test logs and generated curves, shall be certified correct by an officer of the pump manufacturer's corporation and shall be notarized. Contractor shall submit test results as Product Data.

1.07 QUALITY ASSURANCE – ADDITIONAL REQUIREMENTS (NOT USED)

1.08 SUBMITTALS

In addition to the material listed in the detailed specification, the following submittals shall be provided in accordance with Section 01300:

1. Documentation of successful pump designs as specified under paragraph 11050-1.04.B.1. If included as part of the design, the documentation shall include applications where pump cans of a similar size have been provided as part of the design.

2. Certificate of Unit Responsibility attesting that the Contractor has assigned unit responsibility in accordance with the requirements of this section and paragraph 11000-

1.02.C. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.

3. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete 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 will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

5. Documentation of certification in accordance with ISO 9001 as specified under paragraph 11050-1.06.A.

6. Predicted pump performance curves for each condition point specified showing head, power, efficiency, and NPSH required on the ordinate plotted against capacity (in mgd) on the abscissa. Curves for variable speed pumps shall be provided to demonstrate operation at all speeds required to achieve the specified reduced speed operating conditions. All curves shall clearly display the specified operating conditions and the manufacturer's limits for the POR and AOR (as well as on the VFD pump curves), as specified in paragraph 11050-1.04.B.

7. NPSH margin calculations performed for each specified operating condition in accordance with paragraph 11050-1.04.F.2 or .3 as applicable and including the information required under paragraph 11050-1.04.F.1.

8. Motor submittal information as specified in Section 11060. In addition, this information shall include certified calculations for motor rotor and frame reed frequencies, as specified under paragraph 11050-1.04.G.

9. Complete description and sketch of proposed test setup for factory test if a factory test has been required under the detailed specification section. Submittal material shall include sample calculations and proposed test log format. If the Contractor proposes a model test for a part or all of the specified performance tests, the submittal information shall include the proposed model details and a complete description of the proposed method for comparing the model impeller profiles with the impeller profiles for the prototype pumps.

10. Drawings showing general dimensions and confirming the size of pumps, motors, drives and specified appurtenances; piping connections; construction details of equipment (including bearings and bearing isolators); wiring diagrams; and weight of equipment.

11. Variable-speed drive information as required under Section 11069 if the equipment specified includes variable speed capability.

12. Driver unit support calculations and data if the driver is separately supported and if the analysis under the requirements of paragraph 11050-1.05.B. has been required by the terms of these specifications.

13. Shaft deflection calculations for volute type pumps: provide calculations to demonstrate compliance with paragraph 11050-1.04.E, per the methodology set forth as required by Section 11050-1.05.B.5.c.

14. Detail drawings of the pump and driver unit foundation demonstrating conformance to this Section and Section 11002. Submittal shall include drawings depicting type, size, number, projection, and arrangement of anchor bolts, dimensional drawings of the sole and baseplates, dimensional drawings for the concrete supports for both the pump and motor, if applicable. Drawings shall also depict all other pertinent information, including: location of equipment pads and reinforcement; equipment drains; expansion joint locations; elevation of top of grout and grout thickness; elevation of top of baseplate; soleplate; or mounting block; size and location of electrical conduits; and any other equipment mounting features embedded in equipment pads.

15. Limiting nozzle loading criteria, if different from that established by ANSI/HI 9.6.2.

16. The qualifications of the independent testing laboratory and individual personnel proposed by the Contractor to perform field vibration testing, analysis and reporting in accordance with the requirements of paragraph 11050-3.06.

17. The qualifications of the personnel proposed by the Contractor to perform field alignment procedures in accordance with the requirements of paragraph 11050-3.04.

PART 2 PRODUCTS

2.01 MATERIALS

A. GENERAL

Where this section and sections referencing this section are silent with respect to materials of construction on any component, material selection shall follow the requirements of Table H.1, ANSI/API 610, Materials Class I-1, with the exception that all shafts for vertical column type pumps shall be 12 percent chromium stainless steel. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

B. PUMPS

1. FINISH FOR SURFACES IN CONTACT WITH PUMPED FLUID: All pump components in contact with the pumped fluid shall conform to the following requirements.

   Surfaces to be machine-finished shall be indicated on the shop drawings by symbols which conform to ANSI B46.1, Surface Texture, Surface Roughness, Waviness and Lay. Machine surfaces shall be finished to at least the following tolerances (SI units):

   Nominal Roughness:

Surface	Grade, Ref: ANSI B46.1 (SI units)
General Machine Work	3.2 or better
Flange Faces	3.2
Journal Surfaces at Sleeve Bearings	0.4
Hydraulic Surfaces	
Impeller	4.5 or better
Impeller Bowl and Diffuser	3.2 or better
All other wetted surfaces	6.3 or better

   Flaws such as scratches, ridges, holes, peaks, cracks or checks which will make the part unsuitable will be cause for rejection. Machine finished surfaces shall be thoroughly cleaned and coated with protective layer of rust preventive. Small pieces, unassembled pipe or finished bolts, shall be oiled and wrapped with moisture resistant paper.

2. MATERIALS: Unless otherwise specified, wetted cast iron parts for pumps for solids bearing liquid services shall have 2 to 3 percent nickel added to the cast iron.

C. FLYWHEELS (NOT USED)

2.02 GENERAL QUALITY

Details of manufacture and assembly of equipment furnished under this section and referencing sections shall follow the requirements of ANSI/API 610 with respect to the following features (paragraph references, ANSI/API 610):

1. Alignment aids (paragraph 6.1.24).

2. Removal of rotating element (paragraph 6.1.25).

All components or subassemblies weighing 50 pounds or more shall have at least one lifting eye or a provision for threading in a lifting eye. Components 250 pounds or greater shall have lifting eyes or provisions for at least two lifting eyes. Components 1000 pounds or greater shall have at least 3 lifting eyes or provisions for inserting lifting eyes.

2.03 BASEPLATES

Unless otherwise noted in the detailed specification, all pumps shall be furnished by the pump manufacturer with baseplates or mounting plates conforming to the requirements of Section 11002. Baseplates and mounting plates shall be designed to be installed in the housekeeping curb shown and shall be machined flat and co-planar to within 0.002 inch per foot in all directions on the face mating with the pump and motor or driver support.

2.04 REPLACEABLE INSERT RING

The Manufactuer shall supply replaceable insert rings with sharp edged groves to provide trash release pathways. The Inert ring shall be ASTM A-48, Class 35B “Hard-Iron” and will provide effective sealing between the mult-vane semi-open impeller and the volute housings.

2.05 BALANCE

Balancing for pumps with suction nozzle sizes 6 inches in diameter and greater and all associated components shall conform to the requirements set forth in ANSI/API 610, paragraph 6.9.4.1 (equivalent to ISO 1940 or ANSI 2.19 Grade 2.5), unless other portions of this project manual impose more restrictive requirements. Impellers shall be balanced to a balancing grade of G6.3 balancing. It is the intent that the components be balanced as an assembly (“rotor”) in accordance with ANSI/API 610 definitions. For extended shaft pumps, balance impeller(s) and shaft up to the first coupling with the line-shaft.

For separately balanced components, perform a residual unbalance inspection after rotor assembly per ANSI/API 610 requirements, as described in Annex J of that document. Provide copies of worksheets and demonstrate that tolerances are in compliance (i.e. rotor has passed) in addition to other reporting requirements of this paragraph.

All balance logs, certified correct and signed by an officer of the manufacturing corporation and notarized, shall be furnished as Product Data in accordance with paragraph 11050-2.09.

2.06 DRIVE UNIT SUPPORTS FOR SEPARATELY SUPPORTED MACHINES AND INTERMEDIATE SHAFT SUPPORTS

Supports for separately mounted vertical pump drivers and intermediate shaft bearings shall be composite structures of fabricated steel, ASTM A36. Unless otherwise specified, the supports shall be designed to span an opening in the floor sufficient to allow removal for the complete pump. Rolled steel beams shall be provided to stiffen the support and a fabricated steel driver unit support pedestal shall be mounted on the support plate. The support pedestal top plate and all portions of the support plate assembly intended to join with surfaces in the installation structure shall be milled flat and parallel to 0.002 inches per foot. Pedestals shall be provided with access provisions to adjust or assemble/disassemble couplings. The support shall be designed to be supported on a sole plate or sole plates embedded in a house keeping pad at the edges of the floor opening or as indicated. Other details for the driver unit support shall be as indicated.

2.07 FLYWHEEL ASSEMBLIES (NOT USED)

2.08 INLET WELLS FOR COLUMN TYPE PUMPS (NOT USED)

2.09 MACHINING

All machined surfaces shall have a 90 micro inch Ra finish without any grooves, surface imperfections or machining marks of any sort. Mating surfaces shall be coplanar within a maximum of 0.001 inches. Surfaces that are in contact with a gasket such as flanges and casing joints shall have the customary concentric grooves pattern to increase leak path. Bearing housings and seals shall all have collinear centerlines within less than 0.001 inch total difference. Shafts shall have a 64 micro inch Ra finish.

2.10 PRODUCT DATA

The following information shall be provided in accordance with Section 01300.

1. Performance guarantee as specified in paragraph 11050-1.06.C.

2. Equipment anchor calculations specified in paragraph 11050-1.04 E.2.

3. Operation and maintenance information specified in Section 01730.

4. Motor Product Data as specified in Section 11060.

5. Bearing L-10 life calculations.

6. Critical speed calculations demonstrating compliance with paragraph 11050-1.05.B shall be provided if a lateral rotordynamic analysis is required. Otherwise, critical speed calculations demonstrating compliance with paragraph 11050-1.04.C shall be provided.

7. Nozzle loading information required under paragraph 11050-3.01.

8. Motor balance logs, certified and notarized as specified in paragraph 11050-1.04.G.3.

9. Certified balance logs and worksheets, as specified in paragraph 11050-2.05.

10. Installation Certification Form 11000-A as specified in paragraph 11050-3.01.

11. Training Certification Form 11000-B as specified in paragraph 11050-3.08.

12. If factory tests are specified in the detail specification section, certification of satisfactory testing of each unit as specified. The certified material shall include copies of test logs and resulting performance curves. The results of pressure pulse tests shall also be included.

13. Documentation of field alignment data in accordance with Section 11005.

The following are applicable for pumps meeting specified applicability criteria:

1. Results of field vibration tests as specified under paragraph 11050-3.06.

PART 3 EXECUTION

3.01 GENERAL

All pump inlet and discharge nozzles shall be connected to field piping using equipment connection fittings. Restraining rods on equipment connection fittings shall be designed specifically to restrain the unbalanced hydraulic thrust developed by the pump when operating at full speed against a closed valve. All restraining rod nuts shall be torqued to assure that any moment or shear transmitted to the pump nozzles is within the values permitted under ANSI/HI 9.6.2 or that permitted by the equipment manufacturer, whichever is greatest. Where ANSI/HI 9.6.2 is silent with respect to any particular aspect of allowable nozzle loads, the Contractor shall follow the written requirements provided by the equipment manufacturer. Equipment installation procedures shall conform to the requirements of Section 11002. Upon completion of installation work, the Contractor shall submit a complete, properly signed certification Form 11000-A as specified in Section 01999.

3.02 SOLE PLATES (NOT USED)

3.03 PUMP INLET WELLS (NOT USED)

3.04 ALIGNMENT

Journeymen millwrights shall perform alignment of equipment furnished under this section and any referencing section. Carpenters, laborers or any other trades are specifically excluded from performing this work. In locations where such trades are not available, the Contractor shall retain the services of a firm specializing in this type of work to perform the setting and alignment work. The Contractor shall submit the qualifications of the proposed firm to the County for acceptance prior to performing the work. The County shall personally witness final alignment procedures for each item of equipment as a condition precedent to beginning any work required under Section 01660. Alignment techniques shall conform to the requirements of Section 110500.

3.05 FIELD TESTING

Field testing shall conform to the requirements of Section 01660.

Field testing includes lateral and vertical vibration, inlet and discharge pressure pulse and torsional vibration testing, as applicable.

3.06 FIELD VIBRATION AND PRESSURE PULSE TESTS

A. QUALIFICATIONS

The Contractor shall retain the services of an independent testing laboratory to conduct the testing work specified under this paragraph. The work shall be directed by a professional mechanical engineer, registered to practice in any one of the 50 states making up the United States of America. The engineer (hereinafter termed “professional vibration analysis specialist”) shall be a graduate of a college holding ABET accreditation in mechanical engineering and shall have been engaged in the practice of providing the type of monitoring services required under this paragraph for rotating machinery for a period of not less than 10 years. The professional vibration analyst’s qualifications and

references, certified and notarized, shall be submitted for review and acceptance by the County not less than 6 weeks prior to the date scheduled for the field vibration test work specified herein. The County shall review the required documentation and references and indicate acceptance or rejection of the proposed analyst's qualifications within 14 days of submission. If the analyst proposed by the Contractor is rejected, the Contractor shall propose an alternative choice with appropriate documentation.

The independent testing laboratory's testing team (comprised of the professional vibration analysis specialist and any technicians required to complete the specified tasks) shall be fully equipped to provide continuous pressure, velocity and displacement values for all rotating equipment installed under the requirements of this section. Vibration testing equipment shall include sufficient calibrated pressure and flow monitoring devices to determine pump operating conditions as well as vibration levels.

B. VIBRATION TESTS

RMS vibration velocity on any component when the pump is operating at any specified continuous duty operating condition shall not exceed the limits established for the appropriate machine by Tables 8 and 9 in ANSI/API 610 when the pump is operating within the specified operating points.

Vibration test reports shall be submitted as Product Data, directly to the County, and shall bear the signature of the responsible professional vibration analysis specialist. Vibration spectra shall be of sufficient resolution for legibility of magnitude and frequency data to be properly reviewed by the County. Cascade diagrams are not sufficient for variable speed drive application unless supported by the required data in a format suitable for more detailed analyses. Separate spectra shall be provided at the maximum and minimum operating speeds and any potential resonant frequencies.

C. PRESSURE PULSE TESTS (NOT USED)

3.07 FIELD TORSIONAL VIBRATION TESTING (NOT USED)

END OF SECTION

SECTION 11060 ELECTRIC MOTORS

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies three phase, vertical, single-speed and two-speed, low-voltage (600 volts and less), energy efficient (900 rpm) and premium efficiency (1200, 1800rpm) alternating current, induction motors, 250 horsepower or less. Standard NEMA MG 1 motors are specified, as modified herein.

This section also specifies IEEE 841 severe-duty, totally enclosed fan-cooled (TEFC Type-2, specified herein) squirrel cage induction motors from 1 to 500 horsepower with voltage ratings of 230V and 460V

Motors shall be provided in compliance with these specifications. Provide motors suitable for continuous operation under the ambient conditions:

A. Temperature: 0 degree C to 40 degree C.

B. Altitude: 10 feet above sea level.

Motors shall have aluminum rotor material and copper stator windings with F-insulation without exceeding the B-temperature rise of 80-degree C at rated load and with Design-B torque / current characteristics rated for continuous operation duty.

Two-speed motors shall be two-winding motors. Two-speed, one-winding consequential-pole motors that require special motor starters are prohibited.

Refer to Motor Types-1, 2, and 3 Classification and Inverter Duty variable torque and constant torque specification requirements herein. Motor Types-1, 2, and 3 have the additional requirements of Inverter Duty Motors as specified or scheduled.

Enclosures, as specified elsewhere in the Project Contract Documents:

A. TYPE-1 – OPEN DRIP PROOF (ODP)

B. TYPE-2 – TOTALLY ENCLOSED FAN COOLED (TEFC)

C. TYPE-3 – EXPLOSION PROOF (EP)

D. CUSTOM MOTORS (NOT USED)

E. SPECIAL PURPOSE MOTORS: PER DRIVEN EQUIPMENT MANUFACTURER (NOT USED)

1.02 QUALITY ASSURANCE

A. GENERAL

Motors shall be built in accordance with UL 674, UL 1004, and NEMA Standard MG 1. Motor nominal and minimal efficiency shall be based on NEMA MG 1, Table 12-10.

Motors shall comply with Energy Policy Act of 1992 (EPAct) with full-load efficiency measurements per IEEE Standard 112, Test Method B, and shall comply with the requirements specified.

IEC Metric Motors and imported EPAct Motors that do not meet the NEMA standards are prohibited.

B. REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).

If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
IEEE 112	Standard Test Procedures for Polyphase Induction Motors and Generators
IEEE 841	Standard for Petroleum and Chemical Industry-Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 500 HP
NEMA ICS 2	Industrial Control and Systems Controllers, Contactors and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA MG 1	Motors and Generators
NEMA MG1-30	Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with

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Reference	Title
	Adjustable-Voltage or Adjustable- Frequency Controls or Both. Note: Specifications for Standard TENV Submersible Motors rated 1/2 – 200 HP, 140TY-L360TY Frames, and rated at 200, 230, 460, 575, 600 Volt are available from motor manufactures.
NEMA MG1-31	Definite-Purpose Inverter-Fed Polyphase Motors: Rated 5000 horsepower or less at 7200 volt or less, intended for use with adjustable-voltage and adjustable frequency controls, commonly referred to as inverters.
UL 674	Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 1004	Electric Motors

C. FACTORY TESTS

The manufacturer's factory motor Prototype Tests per IEEE Standard 112 Appendix-A on motors through 250 horsepower shall be submitted. Actual factory tests for these motors are not required. The standard routine factory tests shall be conducted, that may include:

1. Winding resistance in ohms and converted to 25 degree C.

2. Resistive Unbalance and Quarter Voltage Impedance, as applicable.

3. Locked-Rotor current (Single phase).

4. High Potential.

5. No-Load Excitation (volts, amperes, RPM).

6. Bearing vibration check.

7. Efficiency, Power Factor, Current at 115%, 100%, 75%, 50%, and no load.

D. WARRANTY

All motors ½ horsepower and greater shall be warranted against defects in materials and workmanship and materials for whichever is the greater of: a 5 year pro-rated warranty from the date of purchase or as provided in the Defect Security Agreement with the County. Month 0 –18 = 100% Month 19-31 = 75% Month 32-45 = 50% Month 46-60 = 25%

All motors specified to conform to IEEE 841 shall be warranted against defects in materials and workmanship for a period of five years.

All warranties shall be submitted in writing and shall include as a minimum 100 percent full payment coverage for parts and labor for repair or replacement of the motor during the entire warranty period due to defective workmanship or materials.

1.03 SUBMITTALS

Submittals shall be provided in accordance with Section 01300 and shall include the following:

1. A copy of this 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, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

   Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Motor Data Sheets:

   a. For all motors other than those specified to conform to IEEE 841, supplier completed "Form 11060-A" in specification Section 01999 with required factory data.

   b. For all motors specified to conform to IEEE 841, manufacturer completed IEEE Standard 841 Data Sheet for AC Squirrel Cage Induction Motors.

   3. Speed-Torque curve per 1.02 C Factory Tests.

   4. Factory test data for motors required to be subject to manufacturer's complete factory dynamometer tests as specified in paragraph 11060-1.02 C.

5. Guaranteed vibration level when measured per MG 1, Figure 7-6:

   a. Displacement: 0.0025 inch peak-to-peak.

   b. Velocity: 0.15 inches per second peak.

   c. Acceleration: 1g (gravity) peak.

6. Motor heating curve for motors per 1.02 C Factory Tests.

7. Motor outline, dimensions, and weight.

8. Manufacturer's descriptive information relative to motor features.

9. Response curve where a winding over-temperature device is required.

10. For all inverter duty motors: Manufacturer's certification that the motor is compatible with the adjustable frequency drive to be used and that the motor meets the requirements of NEMA MG1 Part 31 as required herein.

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1.04 POWER SUPPLY VARIATIONS

Motors shall operate successfully under running conditions at rated load with +/- 10-percent of rated voltage with rated frequency or +/- 5-percent of rated frequency with rated voltage.

1.05 NEMA WINDING TEMPERATURES

NEMA MG 1 Table 12-7 motors insulation system maximum winding temperatures in degrees-Centigrade (C), with the degrees-Fahrenheit (F) insulation system class specified herein.

1. Forty degree-C ambient (104 degree-F) is the basis for temperature rise.

2. For 50 degree C ambient (122F) and above, refer to the driven equipment specifications for additional requirements.

Insulation System Class	Degrees C / F	Temperature Rise by Resistance
A	140 / 284	NA
B	165 / 329	B-rise: 40 + 80 = 120 Degrees C / 248 F
F	190 / 374	F-rise: 40 + 105 = 145 Degrees C / 293 F
H	215 / 419	H-rise: 40 + 125 = 165 Degrees C / 329 F

1.06 NEMA MOTOR TEMPERATURE PROTECTION TYPES

Refer to Thermal Protection in Part-2 for thermal device requirements. The NEMA design shall limit the temperatures of the windings without using a thermal device:

A. NEMA Type-2: Winding Running Over-temperature Protection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

The following manufacturer's motors generally meet the class and performance requirements of this specification when furnished with appropriate modifications and additional features as specified:

A. HORIZONTAL MOTORS (NOT USED)

B. VERTICAL MOTORS

1. Type 3 - Premium efficiency explosion-proof motors manufactured by:

   a. Baldor-Reliance: Super-E Explosion Proof

   b. Emerson US Motors: Type LUCE

   c. General Electric: Type KS, Class I, Group D

d. Siemens:

1) RGZZVESD: solid shaft, EP, hazardous duty, normal thrust, P-Base: 1-250 hp with Temperature Code: T2A
2) RGZZVILESD: solid shaft, EP, hazardous duty, in-line thrust, P-Base: 1-250 hp with Temperature Code: T2A

C. MOTOR TYPES 1, 2 OR 3 RATED FOR INVERTER DUTY SERVICE

1. Baldor-Reliance Electric Inc.:

a. V*S Master XT:

1) Variable Torque rated motor

2) Constant Torque rated motor

2. Baldor-Reliance:

a. Vertical and horizontal.

b. TEBC, TENV, and TEFC:

1) Variable Torque rated motor

2) Constant Torque rated motor

3. General Electric Inc.:

a. KAF design for ODP, TEFC, or TEFC Severe Duty enclosures

b. KAF design in horizontal TEFC Severe Duty and EP enclosures with A$D construction for constant torque: 1000:1

c. X$D Ultra for Severe Duty IEEE 841

d. Value Line WP-1 vertical deep well:

1) hollow-shaft, high-thrust, high-efficiency

2) inverter duty with 4:1 turndown

3) 3600, 1800, 1200 rpm

4) 5-300 horsepower

4. Emerson US Electrical Motors:

a. VFM - Horizontal (TEFC) IEEE 841 Plus S:

1) Variable Torque rated motor: 10:1 turndown

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2) Constant Torque rated motor: 4:1 turndown

5. Siemens:

a. TEFC RGZESDI:

1) Variable Torque rated motor

2) Constant Torque rated motor: 10:1 turndown

b. TEBC RGZESDI:

1) Constant Torque: 1000:1 turndown

2) Blower cooled

c. EP RGZZESDI:

1) Variable Torque: 6:1 turndown

2) Constant Torque: 6:1 turndown

2.02 GENERAL

A. NAMEPLATES

Motor nameplates shall be engraved or stamped stainless steel. Information shall include those items enumerated in NEMA Standard MG 1, as applicable. Nameplates shall be permanently fastened to the motor frame and shall be visibly positioned for inspection.

Additionally, provide the following information on nameplates or additional nameplates for:

1. Motors 1/2 horsepower and larger: Indicate the ABMA L-10 rated life for the motor bearings based on load data.

2. Motors 2 to 50 horsepower: Indicate the NEMA nominal efficiency.

3. Explosion-Proof motors: Indicate UL frame temperature limit code.

4. Space heater information.

5. NEMA MG 1 Over Temperature Protection Type Number.

6. Temperature device rating and alarm and shutdown setpoint information.

B. CONSTRUCTION

All motors provided under this specification shall have the following features of construction:

1. Frames:

a. Cast iron frames for TEFC motors and motors 60 horsepower and larger.

b. Steel frames for non-TEFC motors smaller than 50 horsepower.

c. Aluminum frame motors will not be permitted.

2. Stamped steel or cast metal fan shrouds with non-sparking fan blades.

3. Non-hygroscopic motor leads.

4. NEMA Design-B as standard design. NEMA Design-A, C, or D shall be identified as custom design features in the driven equipment specifications.

5. Motor Service Factor (percent of additional horsepower):

a. SF: 1.15 for Types-1, 2, and 3 Sine-wave motors.

b. SF: 1.0 for Inverter Duty motors.

c. SF dual rating: 1.15 Sine-wave and 1.0 Inverter Duty.

6. Grounding terminal in conduit box.

7. Stainless Steel nameplate.

2.03 MOTORS LESS THAN 1/2 HORSEPOWER (NOT USED)

2.04 MOTORS 1/2 HORSEPOWER THROUGH 250 HORSEPOWER

A. GENERAL

Motors 1/2 horsepower through 250 horsepower shall have copper windings and shall be three phase, squirrel cage, induction type rated for full-voltage start and continuous duty and rated for 460-Vac.

The motor windings and seal housing chambers shall be hi-potted to test for insulation defects and moisture content.

Motors shall have a NEMA MG 1 design for the duty service imposed by the driven equipment such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.

B. RATING

Motors shall be rated 460 volts, three-phase, 60-Hertz, and shall be continuous time rated in accordance with NEMA Standard MG 1. Refer to the driven equipment specification for custom motors or special purpose motors with voltage rating above 460 volts.

Unless specified otherwise, motors shall have a service factor of 1.15 with additional 15-percent horsepower. Motors shall not be required to exceed the nameplate rating at service factor 1.00.

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C. MOTOR TYPE CLASSIFICATIONS

1. GENERAL

a. Definition of terms shall be in accordance with NEMA MG 1.

2. TYPE 1 MOTORS (NOT USED)

3. TYPE 2 MOTORS (NOT USED)

4. TYPE 3 MOTORS

a. Enclosure: Explosion-proof motors (EP or XP).

b. UL listed in accordance with UL 674 for Class I, Group D for Hazardous Atmospheres.

c. Bear UL Label for Class I, Division 1, Group D Hazardous locations.

d. UL-approved breather/drain device in the motor drain hole.

e. Class F insulation.

f. Nameplate: Indicate the UL frame temperature limit code T2A without thermostat and T2D with thermostat.

g. Rated for the UL surface temperature limit codes for Class I Group D for gasoline, petroleum, alcohols, natural gas etc:

1) Motor designed below the UL frame temperature limit code T2A of 280 degrees C or

2) Provide an internal frame temperature thermostat that meets the UL frame temperature limit code T2D of 215 degree C with normally closed contact rated 5-amperes at 115-Vac.

A. THERMAL PROTECTION

Type 3 motors that require motor over-temperature protection, as defined in NEMA MG 1-12, with the motor controller interface wiring and devices as indicated on the drawings for the following:

1. Inverter duty motors and totally-enclosed-air-over (TEAO) motors:

a. NEMA Type-2 motor over-temperature self-protection: Thermal-overload, self-reset bimetallic Klixon switch for motors 5 horsepower and smaller.

b. Motors larger than 5 horsepower require controller alarm / trip:

1) Self-powered by motor temperature or by motor voltage: the motor mounted auxiliary device with two Form-C output contacts wired to

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variable speed or adjustable frequency drive to shut down the motor controller. Both the normally open contact and the normally closed contact shall be available at the motor terminal box for remote alarm and shutdown functions. Indicate the setpoints on the temperature device nameplate.

2) Non-self-powered power thermal devices are prohibited.

3) Factory set thermal protection device with alarm and trip setpoints indicated on the motor device nameplate.

4) Factory wired to separate motor termination box.

2. Motors 300 horsepower and larger and higher voltage. (NOT USED)

3. Auxiliary equipment shall have normally closed NEMA ICS 2 B300 contacts and shall be housed in NEMA 250 enclosures as follows:

a. Type 3 motors NEMA 7D.

B. INVERTER DUTY MOTORS

Motors for use with adjustable frequency controllers shall be inverter duty motors specifically designed for inverter service for the speed range and load torque characteristic required by the associated driven equipment. Inverter duty motors shall be specifically certified compatible with the adjustable frequency controller and driven equipment, as specified in Section 11000-1.02C Unit Responsibility.

Motors for use with adjustable frequency controllers shall not exceed NEMA MG 1, Class B temperature rise when operating over the specified speed range on the adjustable frequency controllers with the specified load speed/torque characteristic.

Inverter duty rated motors shall have 4:1 turndown with variable torque motor controllers or constant torque motor controllers rating designed to operate from 25% of base speed to base speed continuously with full load current and torque without exceeding the Class F insulation with B temperature rise.

Torque requirement for greater turndown and slower speed applications is a custom design; refer to the driven equipment specification for additional requirements. Inverter duty rated motors shall be designed to operate over the speed or frequency range specified.

Motor insulation shall be designed to meet 2000-volt peak at a minimum of 0.1 microsecond rise time which exceeds the NEMA MG 1, Part 31: 1600-volt peak requirement for the 460 volt motors.

Provide inverter duty motors with NEMA Type 2 over-temperature protection as specified in NEMA MG 1-12. Provide motor mounted and motor-powered winding temperature device with a 5-ampere normally open and normally closed output contacts at the motor terminal box for monitoring by the adjustable frequency controller and shutdown where the temperature exceeds 165 degree-Centigrade.

Inverter duty motors shall have electrically insulated bearings or shall be equipped with a shaft-grounding unit mounted on the fan housing with stub shaft extended from the motor shaft. Larger motors, using the shaft-grounding unit, shall be equipped with two brushes, totally enclosed, and sealed against environmental contamination.

C. VERTICAL MOTORS

Vertical motors shall be solid-shaft P-base type specifically designed for vertical installation. Thrust bearing rating shall be compatible with the loads imposed by the driven equipment. Universal position motors are not acceptable.

Vertical motors shall conform to Type 1, Type 2, or Type 3 in accordance with the location and use. Vertical motors specified or indicated as rated for Inverter Duty Motor shall be as specified herein.

D. MOTOR EFFICIENCY

NEMA Premium™ efficiency electric motor, single-speed, polyphase, 1-500 horsepower, 1800-rpm 4-pole, and 1200-rpm 6-pole, squirrel cage induction motors, NEMA Design A or B, continuous rated. NEMA Standards Publication MG 1 2003, in Tables 12-12 and 12-13, respectively.

Table 122
Nominal Efficiencies For "NEMA Premium™" Induction Motors
Rated Medium Volts 5kV or Less (Form Wound)

	Open Drip-Proof			Totally Enclosed Fan-Cooled		
HP	6-pole	4-pole	2-pole	6-pole	4-pole	2-pole
250	95.0	95.0	94.5	95.0	95.0	95.0
300	95.0	95.0	94.5	95.0	95.0	95.0
350	95.0	95.0	94.5	95.0	95.0	95.0
400	95.0	95.0	94.5	95.0	95.0	95.0
450	95.0	95.0	94.5	95.0	95.0	95.0
500	95.0	95.0	94.5	95.0	95.0	95.0

Motors in Table 3 shall be in accordance with IEEE 841 minimum nameplate efficiency for energy efficient 900-rpm 8-pole motors determined in accordance with IEEE 112B testing procedures.

Table 3
IEEE STD 841-2001

Horsepower	Guaranteed Motor Minimum Efficiency (percent)
1	70.0
1.5	72.0
2	80.0

Table 3
IEEE STD 841-2001

Horsepower	Guaranteed Motor Minimum Efficiency (percent)
3	81.5
5	82.5
7.5	82.5
10	86.5
15	86.5
20	87.5
25	87.5
30	89.5
40	89.5
50	90.2
60	90.2
75	91.7
100	91.7
125	92.4
150	92.4
200	92.4
250	93.6
300	94.1
350	94.1
400	94.1
450	94.1
500	94.1

E. CONDUIT BOXES

Conduit boxes shall be sized based on the conduit number and conduit size indicated on the drawings. Provide over-sized boxes with the number of openings as required to accommodate the conduits required. Replace undersized conduit boxes.

Conduit boxes shall be split construction with threaded hubs and shall conform to IEEE 841 for Type 2 motors. Motors shall be furnished with petroleum-resistant gaskets at the base of the conduit box and between the halves of the conduit box

Conduit boxes shall be designed to rotate in order to permit installation in any of four positions 90 degrees apart. Motors shall have grounding lug located within the conduit box for the ground connection.

Provide separate conduit boxes for temperature devices and space heaters.

F. BEARINGS

Bearings may be oil or grease lubricated ball bearings, angle contact roller bearings for axial thrust loads, and cylindrical bearings for radial-only loads. Bearings shall be rated for a minimum L-10 life of 100,000 hours in accordance with ABMA 9 or 11 at the ambient temperature specified.

Motor designs employing cartridge type bearings will not be accepted. Bearings shall be fitted with lubricant fill and drain or relief fittings. Belt loads shall not exceed forces calculated from NEMA MG 1 Table 14-1.

G. LIFTING EYES

Provide lifting eyes per NEMA standard with a safety factor of 5. Generally, motors weighing more than 50 pounds shall be fitted with at least one lifting eye and motors over 150 pounds or 150 horsepower shall be fitted with two lifting eyes.

H. SPACE HEATERS

Where shown on the Drawings or Schedules, furnish motors with space heaters to prevent condensation inside the motor enclosure after motor shutdown and maintain the temperature of the winding at not less than 5-degree C above outside ambient temperature.

Heaters shall be flexible wraparound type rated 120 volts, single phase, 60 Hertz. The space heater rating in watts and volts shall be noted on the motor nameplate or on a second nameplate. Space heater leads H1 and H2 shall be brought to a separate terminal block or pigtails in the motor conduit box or separate conduit box with a threaded conduit opening. Provide separate label on small motors.

I. MOTOR SHAFT GROUND RING

Provide shaft ground ring (SGR) kit during factory motor assembly on inverter duty motors with NEMA ODP enclosures and TEFC enclosures operating on AFD motor controllers, including motors with insulated or ceramic bearings.

SGR kits shall be factory install. If not received with the kits installed, then field install the kits: Install the shaft ground ring, adhesive ring, grounding pig tail in accordance with the manufacturer's installation instructions. Ground the motor frame to the ground grid.

Do not provide SGR grounding kit devices on explosion proof motors located in Division 1 or Division 2 hazardous locations, provide alternate factory provided means.

Provide Electro Static Technology's AEGIS Shaft Grounding Ring Pro Series for Bearing Protection http://www.est-aegis.com/index.html or approved equal:

1. Install circumferential ring of conductive micro fibers to reduce the shaft voltage, to divert current away from the bearings, and to protect bearings in attached equipment.

2. Install on either drive-end or non-drive-end of motors less than 100-horsepower.

3. Insulate the one bearing and install Shaft Grounding Ring on the opposite drive-end of motors 100-horsepower and larger.

4. Install with conductive epoxy to ensure ground connection from the SGR to motor frame.

5. Verify the discharge path for shaft voltages to ground.

2.05 PRODUCT DATA

The following product data shall be provided for each motor in accordance with Section 01300:

1. Operating and maintenance information as part of the motor driven equipment O&M manual as specified in Section 01730.

2. Include overhaul instructions in operation and maintenance information for motor driven equipment that is 50 horsepower and above.

3. Factory motor prototype test results specified in paragraph 11060-1.02 C.

4. Written warranty specified in paragraph 11060-1.02 D.

PART 3 EXECUTION

3.01 GROUNDING AND BONDING

Verify the circuit ground cable (green) is identified and connected to the grounding lug terminal in the conduit box.

Provide supplementary grounding by installing a bond from the motor frame to the grounding electrode system or as indicated on the drawings. Verify Shaft Grounding Rings are installed per manufacturers recommendations.

3.02 FIELD COATING OF MOTORS

Provide motors with the field applied, Epoxy Coating System E-2 with thickness of 16 mils dry film in accordance with specification Section 09900 – Coating Systems for motors located in corrosive environments.

3.03 FIELD TESTING

Verify breather/drain fittings have been installed as specified herein. Winding insulation resistance for motors shall be not less than 10-megohm measured with a 1000-Vac megohmmeter at 1-minute at or corrected to 40-degree C.

END OF SECTION

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SECTION 11069 ADJUSTABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE

Furnish new adjustable frequency drives (AFD) in floor standing cabinet, complete and operable as specified hereinafter. All AFDs shall be provided with bypass starters (RVSS), input and output contactors, line reactors and dv/dt output filters, no exceptions.

The Vendor/Contractor shall provide harmonic testing to ensure that the AFD installation complies with IEEE 519 requirements.

Refer to the drawings for control and monitoring requirements including special interlocking requirements.

B. SYSTEM REQUIREMENTS

The AFD system shall convert 460 volt, 60-Hertz nominal input to a suitable voltage and frequency to cause a premium efficient, inverter duty, squirrel-cage induction motor to run at a speed proportional to an external input analog 4 to 20 ma dc or digital input command as specified for the required AFD speed range.

The AFD system shall include active front end drives, rectifier units, inverter units, control circuitry, protective equipment, input line reactors and output load reactors and other filters and accessories as necessary to provide the specified functions to meet voltage and current harmonics at the specified point of common connection and to mitigate the motor reflected voltage wave. Unless otherwise specified, the point of common connection for AFDs shall be the 480 distribution bus (motor control center, distribution panel, etc.) immediately upstream of the AFD.

The AFD system torque requirement shall match the pump torque requirement. Verify the equipment type and select variable torque (VT) or constant torque (CT). Select 6-Pulse units for motors less than 100 hp and 18-Pulse units for motors 100 hp and larger.

AFDs shall be provided as shown on the drawings.

C. ENVIRONMENTAL CONDITIONS

Ambient conditions are mild nonhazardous and within an climate control electrical equipment only building.

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1.02 QUALITY ASSURANCE

A. REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE 519	IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power System
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts
NEMA ICS 6	Industrial Control and Systems: Enclosures
NEMA ICS 7	Industrial Control and Systems: Adjustable-Speed Drives
NEMA ICS 7.1	Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems
NFPA 70	National Electrical Code (NEC)
UL Standard 508	Industrial Control Equipment

B. INDUSTRY STANDARDS

The AFD shall be UL 508 listed and shall conform to the requirements specified in NEMA ICS 2, 6, 7 and 7.1.

C. UNIT RESPONSIBILITY

The Contractor shall assign unit responsibility for the adjustable frequency drives in this section as specified in paragraph 11000-1.02 C. The Contractor shall submit letters of certification with the shop drawings from the AFD manufacturer, the motor manufacturer, and the driven equipment manufacturer stating that they have reviewed each application and that the combination will satisfy the application duties required, for the actual motor sizes required, regardless of deviations from the scheduled "nominal horsepower."

Manatee County BCC

1.03 PRODUCT HANDLING

AFD units shall be shipped in air-cushion vans to ensure against shipping damage and packed in suitable protective containers. The units shall be inspected upon receipt for damage.

1.04 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

1. A copy of this 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, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

   Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
2. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal.

   If no changes are required, the drawing or drawings shall be marked *"no changes required"*. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
3. Certificate of Unit Responsibility attesting that the Contractor has assigned, and that the manufacturer accepts, unit responsibility in accordance with the requirements of this Section and paragraph 11000-1.02 C. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.
4. Catalog and technical data including outline dimensions, shipping section

   dimensions, weight, and foundation requirements for all assemblies.
5. Schematic diagrams and wiring connection diagram showing functions and identification of terminals.
6. Voltage and current Total Harmonic Distortion (THD) calculations with line reactors or filter design to mitigate harmonics to meet IEEE-519, if applicable.

PART 2 PRODUCTS

2.01 MANUFACTURERS

The Owner and Engineer believes the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's

products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. AFDs shall be installed in the custom enclosure and supplied by Fuji Electric, no equal:

1. Fuji – PNL200-G1/E-46U210420W1

2.02 ENCLOSURES

Enclosures shall be provided as specified in Section 16176 including enclosure types, heating and ventilating.

Provide each indoor mounted AFD in a NEMA 12 ventilated and filtered enclosure with fan cooling and conformal coating protection on circuit boards for corrosive atmosphere protection. The air filters shall be washable type.

Provide outdoor mounted or corrosive area mounted AFD in a NEMA 4X enclosure with dead front enclosure, inner door and panel air conditioning unit for cooling. Enclosures shall be shall meet the requirements of Section 16176.

A. GENERAL

Provide enclosures with AFDs and custom control as required for the project and as indicated on the drawings. Each drive shall be designed for stand-alone operation and multiple drives shall not utilize shared components. Review the project site location, elevation, temperature, humidity, plant atmosphere, and load current-torque requirements to size the AFD and its associated enclosure with requirements specified herein and the control and monitoring devices and interlocks as indicated.

Enclosures shall be designed for indoor service. Each AFD system shall be mounted in a NEMA 250 internally force ventilated enclosure with UL approved Class 1 filters on ventilation openings. Enclosures shall be fabricated from 12-gage minimum thickness sheet steel with an interior frame or formed to provide a rigid structure.

Provide enclosure size to allow entry of power source and motor load cables as indicated on the drawings. Submit drawing of the source and load power cable location within the enclosure and indicated barriers from control and instrument wiring.

Door width shall not exceed 30 inches and shall be hung on removable-pin hinges, with three-point latch hardware, and handle latch for 3/8-inch-shackle padlock.

B. FINISH AND COATINGS

AFD systems enclosures shall be finished with corrosion protection coatings inside and outside for hydrogen sulfide atmospheres. The electrical and electronic assemblies shall have conformal coatings.

2.03 AFD ASSEMBLIES

A. GENERAL

AFDs shall include the following assemblies:

1. Flanged type power disconnect using a thermal magnetic circuit breaker sized for the specific application by the manufacturer.
2. 6 pulse drives shall include a line input reactor or harmonic filter, for harmonic mitigation.. MTE RL reactors, 3-5% impedance open reactor, MTE AP Matrix Filter or approved equal.
3. 6 pulse drives shall include a load harmonic filter with adaptive passive technology for dV/dT mitigation or motor terminator units for addressing dv/dt effects at the motor for all motors 300 feet or more from the AFD. MTE Matrix Series dV or approved equal. For distances between 50 – 300 feet a load reactor shall be provided. MTE RL reactors, 5% impedance open reactor or approved equal.
4. Rectifier, direct current bus filter, and inverter.
5. Control circuitry interface with Operator Interface Unit.
6. Output protection including phase overload.

B. AFD FEATURES

Provided with the following features:

1. Fused control circuit transformer and microprocessor for system logic sequencing functions. Provide fuses with blown fuse indicator lamps.
2. Accept 4 to 20 mAdc speed reference signal.
3. A 4 to 20 mAdc output signal proportional to inverter output frequency for the speed range specified.
4. Adjustable minimum/maximum frequency limits:
   a. Minimum frequency shall be adjustable from 6 to 40 Hertz.
   b. Maximum frequency shall be adjustable from 48 to 90 Hertz.
5. Adjustable and independent timed linear acceleration and deceleration functions, adjustable from 6 to 20 seconds.
6. Current limiting.
7. Automatic restart.
8. Control Wiring:
   a. 600 volt stranded copper
   b. 90 degrees C color-coded insulation
   c. No. 16 AWG
9. Wiring Identification and Termination: Sleeve type markers at each termination point and numbered terminal blocks for external connections.
10. Electrically isolated discrete output contacts for running, remote mode status and trouble alarm.
11. Control Power: Provide a 120 Vac, triple fused, control power transformer for cooling fans and external control circuits when required. Control circuits shall be isolated from power circuits by distance and by insulated barriers.
12. Provide 120 Vac or 24 Vdc as required for Operator Interface Unit.

13. Drives for submersible pump motors shall be furnished with circuitry to interface with the motor leak and temperature protection modules (such as the Flygt CAS module). Coordinate with pump supplier and obtain the pump/motor protection devices for mounting in the VFD enclosure as required. See the pump motor schematic diagram shown on the drawings for additional information.

C. FUNCTIONAL REQUIREMENTS

1. Supply Power: Operate continuously with supply power of 480 volts plus or minus 10 percent, 60 Hertz plus or minus 3 percent and remain on line and operate without damage to the AFD or connected load during a supply power under-voltage variation to the drive up to 85% of its nominal value for 30 milliseconds at full load.

2. Environmental Conditions

   a. Ambient temperature: refer to Section 01800.

   b. N Atmosphere: refer to Contract drawings and Section 16000.

3. Load: Capable of driving the specified maximum motor load continuously and under the following conditions:

   a. Deliver 110 percent of the specified load for up to 60 seconds in variable torque applications.

   b. Deliver 150 percent of the specified load for up to 60 seconds in constant torque applications.

4. Efficiency: Not less than 95 percent at 60 Hertz output driving the specified maximum load at rated torque and speed at 40 degrees C ambient based on measured input power versus output power with all specified components in the system.

5. Frequency And Voltage Regulation: Output frequency regulated to within 0.6 Hertz of the signal/output frequency relationship. Output voltage regulated to within 1.0 percent to produce minimum motor heating at any operating frequency within the specified range.

6. Frequency Range: AFD shall be capable of continuous operation with the specified load at any frequency between 6 and 60 Hertz unless noted otherwise.

7. Space And AFD Access

   a. Enclosure size shall not exceed the size allotments specified on the drawings nor shall any portion of the AFD system exceed a height of 90 inches.

   b. Front accessible only and shall not require rear access.

   c. Mount against the wall without any clearance for ventilation or other purposes.

   d. Submit AFD in the enclosure drawing with the detail of front door and the internal arrangement, including the feeder and motor cables, and the control cables, and the instrument cable location and terminations.

8. Ambient Noise: Free field noise generated shall not exceed 85 dBA at 3 feet out from any point on the AFD enclosure under any normal operating condition.

9. Motor Coordination: AFDs shall be configured as required to maintain output voltage peaks at the connected motor windings from reaching levels damaging to the motor insulation. Provide protection integral to the AFD or as protective hardware to be installed at the motors.

   Where motor terminator units are provided, they shall be rated for the environment in which they are located. Motor terminator units shall be:

   a. Allen Bradley 1204 Motor Terminator for AFD with the maximum carrier frequency of 6 kilohertz,

   b. Cutler Hammer Reflected Wave Trap (RWT) with the maximum carrier frequency of 12 kilohertz,

   c. Or Equal product.

D. PROTECTION AND ANNUNCIATION

1. Overcurrent Protection: Electronic current limit at 150 percent of motor nameplate current and provide motor running overcurrent protection in compliance with NFPA 70.

2. Short Circuit Protection: Protected against load faults: bolted faults, phase to phase or phase to ground shall not damage the unit. Fault protection based on a power source short circuit capacity of 65,000 amperes RMS symmetrical at the AFD power input terminals with impedance or current limiting device provided.

3. Line Voltage: Protected against high and low line voltage all phases.

4. Internal Faults: Internal fault monitoring system to detect malfunctions to protect from transient and sustained faults and to limit damage that may be caused.

5. Motor Over Temperature: Interface to motor over temperature device 2-ampere output contact to shut down and alarm if the motor becomes overheated.

6. Fault Alarm: Indicates the cause of any shutdown visible on the AFD keypad/display without opening the AFD enclosure. As a minimum, the following faults shall be alarmed:

   a. Motor over-temperature.

   b. Motor overcurrent.

   c. Incoming power line over/under/unbalanced-voltage.

   d. AFD over-temperature.

   e. AFD over-voltage.

   f. AFD control failure.

7. Safety Features: The AFD shall include:

   a. Flanged mounted padlockable main disconnect handle.

   b. Mechanical interlock to prevent opening enclosure door with disconnect in the “ON” position while the unit door is open.

   c. Auxiliary contact on main disconnect to isolate 120Vac control power when fed from external source.

d. Barriers and warning signs on terminals that are energized with the power disconnect “OFF”.

e. Separation and insulated barriers between the power and control and instrument products.

f. External emergency stop input.

8. Reverse Direction Protection: Provide protection from inadvertent operation in reverse where reverse rotation can damage the driven equipment.

9. Critical Speed Bypass: Provide capability to program speed bypass for minimum two critical speed points.

10. Transient Voltage Protection: Provide solid state transient voltage protection to meet or exceed ANSI C37.90.

2.04 CONTROL AND MONITORING DEVICES

Front door mounted on the AFD enclosure between 36 and 72 inches above the floor for each unit:

1. Digital Operator keypad/display.

2. Hand/Off/Auto door mounted selector switch.

3. Manual speed control: potentiometer

4. Provide the following local indicators and controls with 30mm NEMA 4 oil tight devices as specified:

   a. Hand/Off/Auto door mounted selector switch.

   b. Status Indicators (ON, OFF, FAULT).

   c. Reset Pushbutton.

   d. Emergency Stop.

   e. Any additional features as shown on the contract drawings; including schematics and P&ID diagrams.

5. Internal terminal strips for remote monitoring:

   a. Run status.

   b. Trouble / Fail alarm.

   c. Auto Mode status.

   d. Motor speed feedback 4-20mA.

   e. Motor Current, 4-20mA.

   f. Additional devices as indicated on the drawings.

A. OPERATOR INTERFACE UNIT

1. Digital keypad/display for monitoring and controlling the drive and to input drive parameter settings with a backlit LCD or equally visible display with a minimum of 16 characters per line.

2. Digital keypad for numerical settings in English engineering units and a guide to parameter settings. Setup operations and adjustments stored in non-volatile EEPROM memory transferable to new and spare boards. Settings shall be protected from unauthorized tampering, revision, or adjustment by a personal lockout code.

3. The digital keypad to provide programming of the drive and include:

   a. Up and Down arrow keys: Increase or decrease output frequency or data values.

   b. Monitor key: Selection of control mode.

   c. Run and Stop keys: Starting and stopping in the manual mode.

   d. Fault clear / Enter keys: Reset fault conditions and enter changes.

   e. Program key: Enter the program mode and adjust parameters.

   f. Remote / Local Location keys: Operation location and local speed control.

   g. Auto / Manual Mode keys: Program mode.

   h. Number keys: 0 through 9 keys to access specific parameters.

   i. Keypad digital illustrations: English and display the last 5 faults.

   j. Frequency / Motor Speed Indication: Calibrated in Hertz and RPM.

   k. Run Status Indication.

   l. Ready Status Indication.

   m. Fault Alarm Indication.

B. CONTROL AND MONITORING COMMUNICATION

1. Additional analog I/O as required for the project.

2. Additional discrete I/O as required for the project.

2.05 KEYPAD FUNCTIONS AND OPERATION

Adjustment of the following parameters through the OIU digital keypad:

1. Current limit and torque boost.
2. Maximum voltage level.
3. Minimum/Maximum speed, Volts/Hertz, Upper and Lower limit.
4. Adjustable acceleration rate and deceleration rate.
5. Electronic thermal overload setting.
6. Coast, controlled ramp or DC injection selectable modes of stopping.
7. PID setpoint and time-function selection.
8. Critical frequency avoidance: Three set points selectable from 0 to maximum frequency with set points adjustable from 0-30 Hertz.

2.06 SPARE PARTS

The following spare parts shall be supplied with each type or frame size AFD:

1. Three sets of all replaceable fuses.
2. 10 of each type pilot light lamp.
3. Three of each type relay.

2.07 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Operation and maintenance information as specified in Section 01730, including:
   a. Final reviewed submittal.
   b. As-built drive configuration settings.
2. Installation certification Form 11000-A as specified in paragraph 11069-3.01.
3. Training certification Form 11000-B as specified in paragraph 11069-3.03.

PART 3 EXECUTION

3.01 FIELD INSTALLATION

Each adjustable speed controller shall be installed and tested by the Contractor with the assistance of factory-trained pump manufacturer engineer/technician and AFD engineer/technician in accordance with the manufacturer's specifications and Section 11069, and witnessed by the Engineer.

Manufacturers' factory representatives shall provide field testing for devices including the setup of the Operator Interface Unit and the setup of the data communication devices, where used. Upon satisfactory completion of the testing, the Contractor shall submit two certified copies of the test report to the Engineer.

Component failure during testing will require repeating any test associated with the failure or modified components to demonstrate proper operation.

The installation shall be certified on Form 11000-A specified in Section 01999.

1. Adjust drive and perform "start-up" tests as recommended by manufacturer. Set parameters and carrier frequency for existing motors to avoid insulation damage.

2. Establish proper direction of rotation for the motor controlled by the drive. Verify that the AFD is precluded from operating in a direction that can damage the driven equipment. Change motor or AFD power lead connection and not the AFD direction, where rotation is incorrect.

3. Verify that the drive will operate properly both in the "manual speed control mode" and in the "remote or automatic mode" from a remote speed signal input.

4. Set the maximum "locked rotor" current drawn during start-up recommended by the manufacturer and approved by the Engineer.

5. Set the minimum and maximum speeds and the acceleration and deceleration "ramps" recommended by the Engineer.

6. Verify the motor high temperature switch contacts are wired into the AFD 120 Vac control circuit and will trip on high winding temperature. Test or simulated the alarm and trip feature at the motor for high temperature and for high vibration, where used.

7. Operate the drive at 100 percent speed for one hour and monitor output current. The output current shall remain below the full load current listed on the motor nameplate.

8. Check for excessive heating of the drive and motor. Report any discrepancies to the Engineer.

3.02 HARMONIC TESTING

The Testing Firm specified in Section 01410 shall perform a harmonics acceptant test with all AFD motor controllers operating to verify compliance with IEEE-519 of less than 5 percent voltage THD and 12 percent current THD at the defined point of common connection when running from Power Utility power source with a BMI-Dranetz or equal harmonic test set that provides a hard-copy record of the test results.

The test shall also be run with power sourced from the standby generator where such a power source is being used at the project site. THD shall be limited to a maximum level of 8 percent voltage THD on standby generator operation.

Submit the test performance to the Engineer per latest version NETA ATS Acceptance Testing Specifications. Refer to the electrical testing specification Section 16030.

3.03 TRAINING

Two hours of onsite AFD operation and maintenance training shall be provided for the Owner's Operation and Maintenance Staff. Manufacturers' factory representative shall conduct the training, upon acceptance of a resume submitted by the trainer. Training shall be certified on Form 11000-B specified in Section 01999.

END OF SECTION

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SECTION 11116 IN-CHANNEL GRINDERS

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies an in-channel grinder complete with electric motor, controller, and all appurtenances.

B. TYPE:

Equipment provided under this specification shall be capable of providing automatic screening and grinding of liquid borne solids with a straight through channel design. The design shall utilize continuous rotating design with high torque and bi-directional rotary cutters intermeshed with stationary cutters. No gaps or opening between the screen and cutters are allowed.

C. EQUIPMENT LIST:

Item	Equipment No.
Influent grinder 1	NR09-G-201
Influent grinder 1 control panel	NR09-VCP-201

D. REFERENCE SPECIFICATIONS:

The general requirements applicable to all mechanical equipment, as specified in Section 11000, are applicable to the equipment specified in this section.

E. DESIGN REQUIREMENTS:

The grinder shall be designed to be installed as shown in a channel to continuously grind solids in wastewater raw sewage. Solids to be encountered during operation of the grinder are those typically found in wastewater and include heterogeneous mixtures of organic and inorganic material. Organic solids include fecal material, vegetable parts, rubber goods, plastics, paper products, bones, small chunks of wood and semi-solid grease particles. Inorganic solids will include rocks, sand, and metal pieces of various sizes and composition. The liquid is expected to contain oil, grease, petroleum products, solvents, and water.

The grinder shall be a cantilevered design with no seals or bearings near the channel floor. The unit's screen shall be stationary. The cutters shall be designed to be interchangeable and be able to be removed or adjusted independently. The seals and bearings shall also be immersed in an oil bath.

The equipment shall be capable of operating either with or without liquid in the channel and shall operate without an external source of water for flushing seals or cutter faces.

The design shall also permit removal and replacement of internal rotating parts without removing the grinder side housings from the channel.

The grinder shall be provided with a dedicated controller to control operation of the machine. The controller shall have sensors designed to detect motor overload and initiate momentary reversal of cutter operation to cure the condition, and then resume normal operation. If the overload clears, normal operation shall be maintained. If the overload reoccurs, the process shall be repeated. If the overload still remains after three attempts within 30 seconds, the controller shall lock out the grinder's control circuits and initiate alarm through dry contacts to an external circuit.

F. OPERATING REQUIREMENTS AND CHARACTERISTICS:

The grinder shall be capable of handling the specified flow rate without the use of moving diverter screen(s).

Equipment furnished under this section shall conform to the following:

Grinder	
Capacity, MGD	7.4
Minimum Average Flow Range, MGD	0.8
Maximum Average Flow Range, MGD	6.4
Maximum Flow, MGD	8.0
Screen Slot Width, inches	0.375
Maximum head loss at rated flow, inches	24 (at 6 MGD)
Cutter teeth, number	
Cutter tooth:	
Height, inches	460
Root diameter, inches	6.940
Weight, lbs	1000
Height, inches	27.5
Motor	
Horsepower, maximum	3
Type (reference Section 11060)	3
Voltage	230/460
Phase	3
Hertz	60
Reduction ratio	35:1

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
AGMA 6010-E-88	Spur, Helical, Herringbone, and Bevel Enclosed Drives
ASTM A36/A36M-94	Carbon Structural Steel
ASTM A536-84 (1993)	Ductile Iron Castings
NEMA 250-91	Enclosures for Electrical Equipment (1000 Volts Maximum)

B. UNIT RESPONSIBILITY:

The Contractor shall assign unit responsibility as specified in paragraph 11000-1.02 C to the grinder manufacturer for the equipment specified in this section. A completed Certificate of Unit Responsibility (Form 11000-C, Section 01999) shall be provided.

1.03 ENVIRONMENTAL CONDITIONS

The grinder will be located at a master lift station indoors in a pumping station wet well. Frequent washdowns can be expected. The temperature of the waste material is expected to range between 50 degrees F and 85 degrees F.

1.04 SUBMITTALS

Submittals shall be provided in accordance with Section 01300 and shall include the following items:

1. Certificate of Unit Responsibility attesting that the Contractor has assigned unit responsibility in accordance with the requirements of this section and paragraph 11000-1.02 C. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.

2. A copy of this 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 will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked “No Changes Required.”

Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

4. Shop drawings for the grinder and control panel.

5. Control panel wiring diagram identifying all internal and face-mounted components and connections to remote equipment.

6. Motor submittal information specified in paragraph 11060-1.03.

PART 2 PRODUCTS

2.01 PRODUCTS

The in-channel grinder shall be DM-T15 Turbo Dimmuntor Open Channel Comminutor as manufactured by Franklin Miller.

2.02 MATERIALS

Component	Material
Grinder plate and frame	316 stainless steel
Shafts	Steel, AISI 4140, tensile strength, 170,000 psi minimum
Cutters	Hardened stainless steel
Fasteners, including bolts, nuts, washers and keys	316 Stainless steel
Grinder and housings, covers, and side rails	Ductile iron, ASTM A 536, or Type A-36 stainless steel
Drive Option	Hydraulipower pack with direct coupling

2.03 EQUIPMENT

A. Mechanism

1. Multiple stainless-steel cutters mounted angularly on support arms of a single rotor shall sweep oversized solids from a special concave semicircular screen in a continuous 360-degree rotation and shred them against vertically mounted stationary cutters.

2. The screen and cutters shall be designed so that the rotating cutters penetrate into the slot openings of the screen to positively clear them of debris. The screen bars shall extend to proximity to the stationary cutters for optimal performance and solids capture.

3. The solids shall be chopped and shredded to a size small enough to pass through the sizing screen. The screen and cutters shall be easily unbolted for repair or replacement without requiring removal of the drive and shaft.

4. The rotating and stationary cutters shall be stainless steel hardened for long life.

5. The screen and hardware shall be constructed of 316 Stainless Steel.

6. The stationary cutters shall be adjustable by means of an eccentric adjuster mechanism.

7. The rotating cutters shall be designed to be interchangeable and rotatable for maximum life. Cutters shall be removable from the machine without requiring unit disassembly. This will allow the lower cutters, exposed to the highest concentration of solids and abrasive material, to be replaced by one of the other (higher) cutters.

8. There shall be no bearings located below the lower cutting elements.

B. Design

1. The main housing shall be constructed of Ductile Iron.

2. The top and bottom housing plates shall be constructed of Ductile Iron.

3. The bi-directional cutters shall be capable of operation in either direction of rotation to even wear and for optimal operation.

4. The unit shall have continuous available torque throughout its 360-degree rotation. The performance of the machine shall be the same for either direction of rotation.

5. The unit shall be designed for continuous 24 hour a day service and shall use an efficient low speed, high torque gear reducer.

C. Configuration

1. The Comminutor shall be easily removed for periodic servicing without need to enter the sewage stream.

2. Lifting points shall be provided.

3. The unit shall employ a cantilevered drive design.

4. The Comminutor shall be constructed with a single, heavy-duty rotating shaft.

5. Radial and axial loads shall be borne by a set of tapered roller bearings on the lower end and a ball bearing on the upper end.

6. Lubrication shall be by oil bath with an oil reservoir located above the bearings to assure optimal lubrication.

7. An oil level port shall be provided above the main unit which shall be easily accessible. Removal of the equipment shall not be required for replenishment of oil.

8. The drive shall be flanged mounted to the equipment and connected by means of a jaw type coupling.

D. Mechanical Seal

1. The mechanical seal shall feature elastomeric members which operate as opposing disk springs when compressed and at the same time keeping the faces of the two hard metallic rings together insuring positive sealing. No metal springs shall be used.

2. The contact-less labyrinth rings shall be supplied to further protect from coarse granular contaminants.

E. Painting

1. All steel or iron structural components shall be prepared and painted in accordance with the following procedures:
    a. The surfaces shall be properly prepared as defined by (SSPC) Steel Structures Paint Council.
2. The metal surfaces shall be blast cleaned to near-white in preparation for painting to substantially remove mill scale, rust, paint or foreign matter including oil, grease, dirt or oxides.
3. The cleaned surfaces shall be primed the same day as cleaned.
    a. The parts shall be painted with 2 coats of Sherwin Williams Micropoxy 646 FF Gray.
    b. One (1) coat primer
    c. One (1) Top coat
4. The dry film thickness shall be 3 to 5 mil per coat.
5. Finish shall be Satin.
6. All stainless steel parts shall not be painted.

F. Reducer

1. The speed reducer shall be a grease-filled cycloidal type reducer with "Heavy-Shock" load classification.
2. Helical gear drives shall not be acceptable.
3. The reduction ratio shall be 35:1.
4. The high-speed shaft of the grinder shall be coupled with the reducer via a coupling.
5. The two-piece, three-lobed coupling shall have jaws that intermesh by at least ¾ inch (19 mm) for dependable torque transmission.
6. The gear reducer shall be fully sealed and capable of operating submerged continuously.
7. A coupling adapter shall be used for accurate alignment and smooth operation. The coupling adapter shall be sealed to prevent water contamination. The adapter shall be firmly connected to the input of the reducer and shall rigidly support the motor weight.
8. The reducer shall have a rigid input shaft supported by heavy bearings capable of handling thrust and radial loads and shock conditions.

G. Motor

1. The motor shall be: Type 3, Submersible-Explosion Proof design.
2. Motor service factor shall be 1.15 with NEMA premium efficiency standards.
3. The unit shall incorporate a submersible explosion-proof motor rated for Division 1, Class 1, Group D and Class 1, Group C&D.
    a. The motor shall be IP68 submersible, continuous in air and while submerged. IP67 motors shall not be accepted.
    b. The motor shall be supplied with 60 feet of cable.
    c. The motor shall contain moisture-resistant class F 155EC/311EF insulation.
    d. The motor shall be Squirrel cage induction, NEMA design B for continuous operation.
    e. The motor shall be capable of continuous operation while submerged to 200 feet.
    f. The motor shaft shall be constructed of AISI 416 Stainless Steel.

H. Channel Frame

1. The CF-3000 channel frame shall support the unit and provide for convenient unit installation and removal.
    a. The frame shall be constructed of AISI 304 stainless steel and shall consist of a one piece angle structure with integral flow diverters.
    b. The one piece frame shall be secured by the means of anchor bolts.
    c. The unit shall slide vertically into a channel slot defined by stainless steel angles.
    d. The CF-3000 shall extend across the channel from wall to wall.
2. It shall not be necessary to bolt or otherwise affix the unit to the channel frame.

I. Controller:

1. GENERAL
    a. The controller shall completely sequence the operation of the equipment covered by the scope of supply.
    b. The enclosure shall be rated NEMA 4X constructed of FRP and suitable for wall mounting. Hinges and latches shall be corrosion resistant. Enclosure shall house the control devices, relays, terminal blocks, and reversing motor components. A provision shall be made within the enclosure for the connection of a grounding cable.
2. POWER FEED
    a. Terminal blocks only shall be provided for the primary feeder cables entering the controller enclosure.
    b. A separate disconnect means with lockout provisions must be provided adjacent to the controller by others.
3. MOTOR STARTER

a. A reversing starter shall be provided for the motor indicated in the job specifications. The size of the starter shall be based on IEC requirements for the motor horsepower, rated 18A minimum. Motor starter shall be a full voltage reversing type with 120 VAC operating coils. Forward and reverse contactors shall have both mechanical and electric interlocks.

1) A motor protection relay shall be furnished as part of the starting equipment. The motor protector shall be adjustable so that the range selected includes the motor nameplate listed FLA (full load amps) rating and the service factor.

2) Repeated unsuccessful attempts to start the motor or a short circuit shall cause the motor protector to trip.

3) Tripping of the motor protector shall stop the motor and flash the trip light. Resetting the relay shall allow the alarm circuitry to be reset.

4) Output terminals shall be provided for connection of the motor leads exiting the enclosure.

4. CONTROL CIRCUIT

a. The following provisions apply to the control circuit:

1) The control circuit voltage shall nominally be 120V.

2) In addition, an adequately sized DC power supply shall be provided where DC is required.

3) The control transformer shall be sized to carry the control-circuit load plus a minimum of 20% spare capacity for future load growth.

4) The transformer primary and secondary side leads shall be fuse protected.

5. OPERATOR CONTROL

a. A three-position “HAND-OFF/RESET- AUTO” selector switch shall be provided for the Grinder. Its function is as follows:

1) Hand: When in this position, the equipment shall run under the control of the PLC until the switch is placed in Off/Reset.

2) Off/Reset: When in this position, the motor shall be prevented from starting (in both the forward and reverse directions); the remote-start signal shall be disabled; and the established Alarm Condition lockout circuitry reset.

3) Auto: In this position, when a remote Run signal is received, the motor shall cycle under the control of the PLC. The cycle shall be terminated if the run signal is interrupted, or the selector switch is placed in the Off/Reset position or if the equipment experiences an Alarm Condition.

b. Indicators: The following full voltage LED indicators shall be provided:

1) A white “POWER ON” pilot light shall be illuminated when power is available on the secondary side of the control transformer.

2) A green “RUNNING” indicating light shall be illuminated when the selector switch is in the Hand or Auto position with the equipment motor running in the forward or reverse direction, and during motor reversal pauses.

3) A red “TRIP” indicating light shall:

c. Be illuminated steadily when the selector switch is in the Hand or Auto position and the equipment has experienced an Alarm Condition stoppage.

d. It shall remain illuminated until the selector switch is placed in the Off/Reset position, resetting the Alarm Condition Lockout circuit.

e. Flash when the motor protection relay trips.

1) “Double flash” when the motor winding temperature causes the embedded thermostats to open.

2) A red “SEAL FAIL” indicating light shall be illuminated when excessive moisture is detected in the submersible motor.

6. REMOTE I/OS:

a. The following inputs and outputs shall be supplied.

1) Run Status: A Form C dry-contact output shall close when the equipment motor is running (and during motor reversal pauses). It shall open when the equipment is stopped, trips on an Alarm Condition, or power to the controller is disconnected.

2) Trip Status: A Form C dry-contact output shall close when the equipment experiences an Alarm Condition stoppage. It shall open when the Alarm Condition lockout circuit has been reset.

b. The contact shall also close and remain closed (no pulsing) when the motor overload relay trips. It shall open when the relay is reset.

1) Motor Thermostats: Provisions shall be made for connection of motor thermostats to indicate Motor over temperature failures. Thermostats shall be connected to individual inputs on the PLC.

2) Remote E-stop: Provisions shall be made for connection of a maintained contact pushbutton (by others). Depressing the pushbutton shall disable the system. The terminals shall be jumpered (to be removed if installed).

3) Remote Start: Provision shall be made to accept a remote contact closure input (by others) that shall start the cycle when the selector switch is in the Auto position.

J. PLC:

1. A programmable logic controller shall be provided within the controller.

a. PLC shall be manufactured by IDEC or Siemens.

b. A minimum of 72k programming memory shall be provided with a minimum of 80% of space available for future expansion.

c. PLC shall have an integrated Ethernet port capable of Modbus/TCP communications.

d. Terminal blocks shall be removable to allow for replacement of the PLC without requiring wire removal.

e. The PLC shall have a USB programming port and an SD slot to allow for uploading and downloading of a program without requirement of a PC.

K. INSTRUMENTATION:

1. The following items shall be included as part of the controls of the subject equipment.

a. Current Sensor: One phase shall be monitored for a high current condition (for the Grinder) with a current sensor and current relay. If the phase current reaches an adjustable set point, the appropriate motor starter shall be de-energized and after a five second delay [user adjustable], an "Auto-Clear" sequence as described below shall be initiated. When starting the motor, the control should delay looking for a signal from the current sensor for 1.5 seconds [user adjustable] to avoid tripping on motor inrush currents.

b. Panel mounted pilot lights shall be full voltage LED 120VAC and visible in sunlight.

2. To meet Sunlight Visible requirement, indicators shall have a minimum luminous intensity of 542 mcd and a minimum luminance of 1482cd/m2.

a. Moisture Detection: A moisture relay shall be provided within the enclosure. When the probe in the motor detects excessive moisture, the grinder motor is de-energized, the Seal Fail light is illuminated, and an Alarm Condition lockout circuit is established. Terminals shall be provided for sensor leads.

L. Operation:

1. The Grinder shall be controlled via a reversing motor starter that will normally operate in either direction.

2. Normal Cycle: When the selector switch is turned to the Hand or Auto position (only after receiving a remote Run signal if in Auto), the equipment shall start and run in the direction opposite from the direction it was running when it was last stopped.

a. If the equipment runs for more than two hours without experiencing an Alarm Condition, the motor starter shall be de-energized.

b. After a two second delay (adjustable) to allow the equipment to coast to a stop, the grinder shall run in the opposite direction.

c. The automatic reversals shall continue until the cycle is stopped by interrupting the remote-run signal, or by moving the selector switch to the Off/Reset position, or if a Jam occurs.

d. This periodic rotation direction change aids in cleaning the equipment.

3. Auto Clear Cycle: If the phase current reaches an adjustable set point (factory-set) at any time within the 2-hr cycle, the motor starter shall be de-energized. After a two second delay (adjustable), the equipment shall automatically restart in the opposite direction of rotation in an attempt to clear the Jam.

a. This auto-clear cycle shall be repeated a total of four times.

b. If at any time the equipment runs for more than 30 seconds in the forward direction during the four attempts, the reversal counter shall be reset.

4. Alarm Condition: If after four tries, however, the Jam condition still exists, the forward starter coil shall be de-energized, and after a two second delay, the reverse starter coil shall be energized for one second then de-energize. An Alarm Condition lockout circuit shall be established and remain in the alarm state until it is reset.

   a. The lockout circuit shall disable the automatic cycle, cause the Trip pilot light to be illuminated, the Trip Status contact to close, the Running pilot light to be extinguished, and the Run Status contact to open. Once the obstruction has been cleared, the Alarm Condition lockout circuit can be reset by moving the selector switch to Off/Reset position.

2.04 SPARE PARTS

The following spare parts shall be provided:

One (1) mechanical seal
One (1) set of rotary and stationary cutters

Spare parts shall be tagged and stored in accordance with paragraph 11000-2.12.

2.05 PRODUCT DATA

The following product data shall be provided in accordance with Section 01300:

1. Applicable operating and maintenance information specified in Section 01730.
2. Motor product data specified in paragraph 11060-2.05.
3. Product data for equipment control devices specified in paragraph 11010-2.09.
4. Completed Installation Certification Form 11000-A (Section 01999) specified in paragraph 11116-3.01.
5. Completed Training Certification Form 11000-B (Section 01999) specified in paragraph 11116-3.03.

PART 3 EXECUTION

3.01 INSTALLATION

The equipment shall be installed as specified and in accordance with the manufacturer's written recommendations. The equipment shall be installed and tested under the direction of factory-trained personnel. The installation shall be certified on Form 11000-A specified in Section 01999.

3.02 TESTING

After completion of installation, the equipment shall be completely tested to demonstrate compliance with operating requirements as specified. Inspection, testing, and certification

shall be provided, and testing procedures and forms shall be submitted and used, as specified in Section 01660.

3.03 TRAINING

A factory-trained representative shall train plant personnel in operating and maintenance procedures for the equipment provided under this section for not less than eight (8) hours. Training shall conform to Section 01664 and shall be certified on Form 11000-B specified in Section 01999.

END OF SECTION

SECTION 11305 VARIABLE-SPEED, SUBMERSIBLE WASTEWATER PUMPS FOR WET- AND DRY-PIT APPLICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. This section specifies dry-pit submersible pumps suitable for pumping fluids containing solids-bearing sewage from a lift station at infinitely variable speed.
2. Pumps furnished under this specification shall have discharge nozzles greater than or equal to 4 inches in diameter.
3. Each pump will be driven by a single variable speed drive provided under Section 11069. The pump vendor shall submit a letter of confirmation on the suitability for use of the Supplier/Subcontractor's proposed drive selection.
4. Pumps will be installed in dry-pit configuration as specified herein. Pumping units for dry-pit configurations shall be complete with motor, inlet elbow, integral cooling system, supports and mounting plates, and other accessories as specified.
5. Manufacturers proposing to furnish equipment specified under this section shall hold current certification under ISO 9001-2015).
6. Equipment shall additionally conform to the requirements of Section 11050 where specifically referenced in this Section.
7. The selected pump shall have the ability to accept a smaller impeller in future that can be swapped in the same selected pump and meet these future flow conditions as defined in Part 2.03 Performance / Design Criteria.

B. Equipment List:

Item	Equipment Number	Configuration (Wet/Dry)
MLS N1-B Pump 1	NR09-P-201	Dry-Pit
MLS N1-B Pump 2	NR09-P-202	Dry-Pit
MLS N1-B Pump 3	NR09-P-203	Dry-Pit

1.02 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 11000 General Requirements for Equipment
2. Section 11002 Rigid Equipment Mounts
3. Section 11050 General Requirements for Pumping Equipment
4. Section 11069 Variable Frequency Drives
5. Section 11060 Electrical Motors
6. Section 11069 Adjustable Frequency Drives

1.03 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. References shall be as listed in Section 11050.

1.04 DEFINITIONS (NOT USED)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. See Section 01010: Work Sequence.
   2. Coordinate pump and motor operational and starting characteristics with adjustable-frequency drive settings used for control of this equipment. A system curve is available upon request from the Engineer. Include the following:
      a. Motor minimum operational speed
      b. Motor maximum operational speed
      c. Motor ramp-up and ramp-down speed, voltage, and hertz requirements
      d. Other operating limits that are imposed by the driven equipment for operation and warranty

B. Unit Responsibility:
   1. Assign unit responsibility, as specified in Section 11000, to the manufacturer of the submersible pumps provided for all equipment and accessories under this section. Provide a completed, signed, and notarized Certificate of Unit Responsibility (Form 11000-C, Section 01999). Unit responsibility for the pump manufacturer includes the motor, pump, baseplate, and mounting plate.
   2. Pump manufacturer shall review submittal data for the variable speed drive units that are proposed by the Supplier/Subcontractor under Section 11069. The manufacturer shall submit a letter indicating whether the proposed VFD units are satisfactory or not for use with the pumps in this section.

1.06 SUBMITTALS

A. Action Submittals:
   1. Procedures: Section 01300.
   2. Submittals shall conform to the requirements of Section 11050. A copy of this Section, addendum updates included, along with the sections listed below shall be submitted with each paragraph check-marked to indicate compliance or marked to indicate requested deviations.
      a. This Section (11305)
      b. Section 11000 General Requirements for Equipment
      c. Section 11002 Rigid Equipment Mounts
      d. Section 11050 General Requirements for Pumping Equipment

e. Section 11060 Motors

f. Section 11069 Variable Frequency Drives

3. The specification copies shall be complete 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 Supplier/Subcontractor, 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 will signify compliance on the part of the Supplier/Subcontractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

5. Unit Responsibility Certification form (Form 11000-C) attesting that unit responsibility has been assigned in accordance with the requirements of this Section and Section 11000. No other submittal material will be reviewed until the certificate has been found in conformance with this requirement.

6. Predicted pump performance curves for each condition point specified showing head, power, efficiency, and NPSH3 on the ordinate plotted against capacity on the abscissa. Curves shall be provided to demonstrate operation at all speeds required to achieve the specified reduced speed operating conditions. All curves shall clearly display the specified operating conditions, POR and the manufacturer's limits for the AOR.

7. Drawings showing general dimensions and confirming the size of pumps, motors, drives and specified appurtenances; piping connections; construction details of equipment (including bearings and bearing isolators); wiring diagrams; and weight of equipment.

8. Manufacturer's data including materials of construction and equipment weight.

9. Motor Data Form 11060 -A.

10. Proof of service of previously installed units of similar size and similar configuration (wet or dry-pit) of the type specified in this Section.

11. Written factory tests report, as specified in paragraph 2.09.

12. Supporting calculations:

    a. Shaft deflection and documentation required per Section 11050

    b. Pump baseplate/frame and anchorage (incl. anchor bolt) and required documentation

    c. Cooling system

13. Manufacturer's operation and maintenance information in accordance with Section 01730.

14. Installation Forms in accordance with Section 11000.

15. 5-Year warrantee in accordance with paragraph 1.09.
16. Testing Forms in accordance with Section 01999.
17. Field vibration test protocol and data as specified in ANSI/HI 11.6.

B. Informational Submittals:
1. Procedures: Section 01300
2. Equipment submittals shall conform to the requirements of Section 11050.
3. Documentation attesting to current ISO9001 certification, signed by an officer of the manufacturer's corporation and notarized.
4. Letter of confirmation of suitability of variable frequency drives being provided by the Supplier/Subcontractor for this equipment in accordance with Section 11069.
5. Coordination items required for proper setup of the variable frequency driver as specified in paragraph 1.05.A. Coordination.

C. Closeout Submittals:
1. Operating and maintenance submittals:
   a. Procedures: Section 01730.
2. Spare parts:
   a. Procedures: Section 11000.
   b. Provide the following spare parts for each model and size of pump furnished for this Section, Provide a breakdown of replacement cost along with a listing of spare parts within the shop drawing submittal:
      1) One removable cable seal chamber cap with cable length as required in this Section.
      2) Any additional spare parts as recommended by the manufacturer

1.07 QUALITY ASSURANCE

A. Qualifications:
1. Independent testing agent hired by the Supplier/Subcontractor for field vibration testing: Section 11050.
2. Critical Speeds: Critical Speeds shall be in accordance with Section 11050-1.04.
3. Vibration Limits:
   a. Vibration limits for submersible pumps shall be in accordance with ANSI/HI 11.6.
   b. Field testing shall be in accordance with paragraph 3.03 of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01620

1.09 SPECIAL WARRANTY

A. Provide a Special 5-Year Warranty. All pump assemblies shall be warranted against defects in workmanship and materials for whichever is the greater of: a 5-year pro-rated warranty from the date of purchase or as provided in the Defect Security Agreement with the County. Month 0 –18 = 100% Month 19-31 = 75% Month 32-45 = 50% Month 46-60 = 25%.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. The manufacturer's standard product may require modification to conform to specified requirements:

1. Xylem - Flygt

2.02 TYPE

A. Heavy-duty, submersible, vertical shaft, centrifugal non-clog type, suitable for pumping fluids containing wastewater solids s as specified herein.

B. Designed for continuous or cyclic operation under various wet well conditions without damage to the pump and motor.

C. Special attention shall be devoted to the shaft design to limit deflection under all operating conditions, as specified in this section.

2.03 PERFORMANCE/DESIGN CRITERIA

A. Operating Conditions:

1. The performance requirements presented in tabular form below are intended to describe the results of hydraulic calculations developed using a mathematical modeling program specifically developed for the purpose. The model was intentionally used to develop the limits of expected extremes in variation of static head, coefficients for pipeline resistance and turbulence losses through fittings and valves.
2. Equipment furnished under this section shall be fully suitable for continuous operation at any specified condition or any condition lying between the extremes of the operating conditions specified in the following table. The total head in the information below is the total system head at the operating capacity, essentially a summation of the head of the two pumps at that capacity. The notes presented at the end of the table are intended to be complimentary to the information presented in the table.

B. Table of Operating Conditions:

Full Speed Operation

Condition A[1,5]

Capacity, mgd	2.55
Total head, feet	232
NPSHA, feet	18.3

Condition B[2,5]

Capacity, mgd	2.07 (from pump H/Q curve)
Total head, feet	193

Reduced Speed Operation

Condition C[3,5]

Capacity, mgd	1.44
Total head, feet	134
Pump speed	Reduced

Condition D[3,5]

Capacity, mgd	0.91
Total head, feet	104
Pump speed	Minimum

Future Operation

Condition E[4,5]

Capacity, mgd	1.55
Total head, feet	163
Pump speed	Full Speed

Condition F[4,5]

Capacity, mgd	2.37
Total head, feet	128
Pump speed	Full Speed

Condition G[4,5]

Capacity, mgd	1.70
Total head, feet	104
Pump speed	Reduced

Condition H[4,5]

Capacity, mgd	1.06
Total head, feet	102
Pump speed	Minimum

NOTES:

1. Condition A shall be taken as the rated, continuous-duty operating condition. Performance at the rated condition shall be guaranteed in accordance with Section 11050. Condition A has been selected to obtain the rated pumping capacity for the installation. It is not intended that the pumps be selected for maximum efficiency at Condition A. Pumps furnished under this section should be selected to achieve Condition A performance, but also operate continuously without objectionable vibration or cavitation at the head specified under Condition B. Condition A may be located in the Allowable Operating Region as established by the pump manufacturer

in accordance with ANSI/HI 9.6.3 and published in the manufacturer's published application data for the specific model proposed for this application.

2. Condition B head is presented to indicate operating conditions when the pump is operating at **maximum speed against minimum anticipated system head**, assuming a hypothetical head-capacity curve. **Condition B shall be used for pump selection**. **Condition B shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.** Pumps with head-capacity curves steeper than that assumed will produce somewhat less flow at somewhat lower head. The reverse will occur with pumps having a shallower head-capacity curve. ***Proposed pump selections meeting this discharge head requirement by operating the equipment at less than full speed will be rejected.*** NPSHA, as listed for Condition B is calculated on a pumped flow of **2.07** mgd.

3. Condition C is the anticipated reduced continuous duty minimum speed condition. Pumps furnished under this specification shall be capable of sustained (24 hours per day) operation at this condition within the requirements set forth in Section 11050. Condition C shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application. Condition D represents the anticipated minimum continuous duty speed condition.

4. Condition E, F, G, & H represents the future full speed (E &H), reduced (G) and minimum (H) continuous duty speed conditions. The selected pump shall have the ability to accept a smaller impeller in future that can be swapped in the same selected pump and meet these future flow conditions.

5. Total head in the above tabulation is the algebraic difference between the discharge head and suction head as defined in ANSI/HI 1.1 – 1.6. Net positive suction head available (NPSHA) in the above tabulation is referred to the pump at centerline elevation (project datum) as shown and is calculated in accordance with ANSI/HI 1.3 for average barometric pressure and maximum temperature conditions. NPSHA at the pump impeller eye can be determined by adjusting the given value by proposed pump dimensions and the indicated requirements for pump installation details. An allowance of five feet has been included for the presence of volatile constituents in the pumped fluid. Required NPSHA margin shall be as specified in Section 11050.

C. Design Requirements:

Equipment provided under this section shall conform to the following:

<u>Pump</u>

Rigid sphere, inches diameter (min.),
capable of passing through the
pump from inlet to discharge 3

Maximum efficiency at maximum speed, minimum, percent[a]	72.2
Piping connection size, inches, minimum	
Inlet	8
Discharge	6
Operating speed, rpm, maximum	1780
Motor	
Horsepower, maximum	160
Enclosure	Type 3, energy efficient, inverter duty

[a] Minimum acceptable efficiency at the Best Efficiency Point (BEP) at the speed required to achieve the performance specified under Condition Points A and B. The minimum acceptable efficiency at the BEP is not necessarily associated with any operating condition specified in Paragraph 11305-1.01 E.

2.04 SYSTEM OPERATION

A. The pumps will be installed in dry-pit configurations as shown on the Drawings with sufficient space for access to install and remove the equipment.

B. The pumps will be operated at variable speed, responding to a control system that will vary the speed of the pumps according to the following general control strategies:

Pumping System	Primary Control Parameter	General Control Strategy
MLS N1-B Pumps	Wet Well Fluid Level	Pumps start based on level and adjust speed to maintain a flow set point

C. Specific control strategies for each pumping system are specified in Section 17000 and shown on the Process and Instrumentation Diagram (P&IDs) drawings.

D. The control systems will incorporate minimum speed settings for the pumps to maintain normal pump operation within the respective pump's Preferred Operating Region (per ANSI/HI 9.6.3) to the maximum extent possible. The minimum speed settings will be coordinated with the Owner and pump manufacturer during the submittal review phase and finalized in the field during start-up.

2.05 MATERIALS

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Supplier/Subcontractor may propose alternative materials for the purpose of providing greater strength or to meet required stress

limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

B. Provide materials of construction in accordance with the following table:

Component	Material
Pump and motor casing	Cast iron, ASTM A48, Class 35B
Discharge elbow	Cast iron, ASTM A48, Class 35B
Inlet nozzle and bell	Cast Iron, ASTM A48, Class 35B or forged steel
Impeller	ASTM A532-IIIA Hardened Cart Iron
Motor and pump shaft	Stainless steel, ASTM A479 S43100-T
Insert rings	Inset Ring – ASTM A532-IIIA Hardened Cart Iron
External bolts and nuts	Stainless steel, ASTM A276 Type 316
Guide bar brackets (Where applicable)	Stainless steel, ASTM A276 Type 316
Anchor bolts	Stainless steel, ASTM A276 Type 316

2.06 COMPONENTS

A. General:

1. Motor and rotating parts shall be removable from the motor end of the pump.
2. Motor mating surfaces where watertight sealing is required shall be machined and fitted with nitrile O-rings.
3. The pump shall be listed by Factory Mutual or Underwriters Laboratory as conforming in all respects to the requirements in UL 674.

B. Casing:

1. One-piece casting specifically designed to bear the loads associated with removal and placement of the pump when submerged or exposed and to withstand the loads imposed by the operations specified in this Section.
2. Tangential or center discharge nozzle.
3. Designed for efficient conversion of kinetic to potential energy and shall have clear passageways designed to pass the solid sphere specified in this Section.
4. The cutwater shall be specifically designed for use in fluids with stringy solids and rags.
5. The discharge nozzle shall be not less than the diameter specified in this Section and shall be reinforced for the loads imposed by the specified conditions of service.
6. The nozzle flange face shall be designed to mate with the discharge fitting specified in this Section.
7. Where specified, the volute casing shall be drilled and tapped or otherwise fitted to accept an inlet nozzle or elbow conforming to the requirements specified in this Section.

C. Shaft:

1. Turned, ground, polished, and of proportions suitable for use in the specified application.
2. Sized to limit deflection at the shaft seal to not more than 4.0 mils when the pump is operating at any continuous-duty point defined by the envelope of conditions specified in this Section.
3. Distance from the lower bearing to the hub of the impeller shall not exceed two times the diameter of the shaft.

D. Bearings:

1. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

E. Impeller:

1. Dynamically balanced
2. Non-clogging design, capable of passing solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications completely through the pumps to the discharge nozzle.
3. Minimum two-vane design
4. Fit between the impeller and the shaft shall be:
   a. Option 1: Sliding fit with a taper-lock bushing pressed by a screw that is threaded into the end of the shaft, or
   b. Option 2: Slip fit onto the shaft and drive key and fastened to the shaft by an impeller nut having cover for protection from pumped fluid.
5. Wearing ring system: Abrasion resistant, providing efficient sealing between the volute and impeller.
6. Impellers shall be fitted to prevent coming off during period of reverse rotation (may occur after stopping).

F. Mechanical Seals:

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and

lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

G. Motor

1. Squirrel-cage induction, shell type design, housed in an air-filled or an oil-filled, watertight chamber, NEMA B type Inverter Duty with a service factor of 1.15 based upon nameplate rating.
2. Motor shall be rated for operation with specified VFD.
3. Furnish an unqualified warranty guaranteeing (full replacement at no cost to the County) the performance of the motors furnished under this project for a period of five years when operating under the specified conditions.
4. The stator winding and stator leads shall be insulated with moisture resistant Class H insulation, which shall be rated at a temperature of 180 degrees C.
5. Provided thermal sensors as specified in this Section to protect the motor from excessive heating.
6. Temperature rise not to exceed NEMA MG-1 requirements for class B insulating materials when operating continuously under load.
7. Motors shall be Factory Mutual or UL listed in accordance with UL 674 and 1207 for the area classification indicated in paragraph 2.03
8. The motor shall be designed for continuous duty in air and in 95 degree Fahrenheit water, capable of sustaining a minimum of 15 starts per hour when operated with variable frequency motor controllers.
9. The junction chamber, containing the terminal board, shall be hermetically sealed from the motor.
10. Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board.
11. Motors shall be explosion proof.

H. Pump Shaft:

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

I. Cooling System:

Cooling Jacket Equipped

Each unit shall be provided with an integral motor cooling system. A stainless-steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

J. Temperature Sensors:

1. The stator shall be equipped with three thermal sensors, embedded in the end coils of the stator winding (one sensor in each stator phase).
2. Sensors shall be wired to the specified motor protection relay for motor protection.

K. Moisture Detection:

1. Provide motors with a moisture detection system.
   a. A primary moisture detector shall be provided in the stator housing leakage chamber.
   b. A second moisture detector shall be located in the motor junction box or inspection chamber.
2. All moisture detectors shall be wired to the motor junction box for connection to the specified motor protection relay.
3. Moisture detectors shall be either mechanical float switch or capacitance probe type as recommended by the manufacturer.

L. Motor Protection Relay:

1. Provide motor protection relay to protect motor from high temperature and moisture.
2. During normal pump operation, the temperature switch shall be closed and the leakage switch shall be normally open. Sensor circuit shall operate on 12 or 24 VDC feed from the main relay body. The relay shall be provided with LEDs to indicate status of relay on face for leakage, temperature, and supply voltage.
3. Latch detection of open temperature switch. An external reset shall be required to clear alarm. Retain relay state during power failures for temperature.
4. Moisture detection shall auto reset.
5. Power supply: 120 VAC.
6. Provide SPDT contacts for the following remote alarm functions:
   a. over-temperature
   b. moisture detection
7. UL or UR approved, suited for panel installation.
8. Relay shall be mounted inside the associated pump's motor controller . Mounting shall be DIN rail mount or back panel mount. Coordinate to provide relay for installation at the shop where the associated motor controller is being fabricated.

This includes installation by motor control center manufacturers and individually mounted variable frequency drives. Coordinate size, wiring, and mounting of the relay into the motor controller.

9. Relay manufacturer shall be Xylem-Flygt.

M. Variable Frequency Drives:

1. Provided separately by the Supplier/ Subcontractor in accordance with Section 11069, the Contract electrical one-line diagrams, and the Contract wiring diagrams.

N. Cables:

1. Cable:
   a. The pump shall have three cables. Two cables shall be for power, one cable shall be for control (the motor thermal sensors and moisture detector).
   b. The cable design shall be suitable for installation in a municipal wastewater pumping station.
   c. The cable length shall not exceed the product manufacturer's recommended length.
   d. The Supplier/Subcontractor shall be responsible for determining the length of cable required to wire the motors and sensors from the wetwell to the terminal boxes.
   e. The Supplier/Subcontractor shall provide additional cable length for slack to allow the pumps to be removed from the wetwell.
   f. The length of cable for slack shall be based on the pump manufacturer's recommendation.
2. Cable Seal:
   a. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary, using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.
3. Cable Disconnection:
   a. The pump shall be designed such that power/ control cable can be removed from the pump motor without breaking the cable seal. The power/ control cable shall be sealed to a removable motor chamber cap that shall be universally mateable to the same manufacturer's pump series. The pump shall be able to be removed from the wetwell and disconnected from the cable by removing the motor chamber cap. A spare removable chamber cap with 15 feet of cable shall be provided.

O. Terminal Boxes:

1. Provided separately under Division 11

P. Inlet Nozzle: (NOT USED)

Q. Wet-Pit Configuration Mounting (NOT USED)

R. Dry-Pit Configuration Mounting:

1. Inlet Elbow:
   a. Provide a flanged suction elbow to provide a smooth transition of flow from the connected suction piping to the impeller eye.
   b. Inlet elbow shall be of the concentric reducing type, sized to connect directly to the suction pipe diameter shown on the Drawings.
   c. Handhole:
      1) Provide a handhole, not less than 4 inches in diameter, for access to the impeller and wearing rings.
      2) Contoured to match the inner contours of the elbow
      3) Bolted-in-place design.
      4) Drilled and tapped and fitted with a valved 2-inch diameter drain.
2. Pump Base Design and Supports:
   a. Pumps shall be mounted to parallel concrete pedestal supports as shown on the Drawings.
   b. Provide a suitable base plate, frame or other mounting provisions for anchorage to the concrete supports such that the anchor bolt holes shall be centered on the concrete pedestal supports. Note that configuration requirements may not accommodate the pump manufacturer' standard equipment mounting design.
3. Mounting Coordination:
   a. Coordinate required height of concrete pedestal supports with required discharge piping elevations show on the Drawings.

2.07 FINISH

A. Procedures: Section 09900

B. Prime Coat: Shop applied, coating material per Section 09900

C. Finish Coat: Shop applied, coating material per Section 09900

2.08 SOURCE QUALITY CONTROL

A. Provide non-witnessed factory testing at a location in the Continental United States and in accordance with Section 11050.

PART 3 EXECUTION

3.01 INSTALLATION

A. Execution shall conform to the requirements set forth in Section 11050.

3.02 FIELD TESTS

A. General:
   1. Unless specified otherwise, pumps shall be individually operated at all specified operating conditions. The Contractor shall provide the means to recirculate pumped fluid or, alternatively, throttle the pumps to achieve the specified head at specified flow.
   2. All field tests shall be witnessed by the Engineer.

B. Vibration, Dry Pit:
   1. Field vibration testing shall conform to the requirements set forth in Section 11050.
   2. Contractor shall provide all sensors and monitoring equipment.
   3. Overall vibration levels (peak velocity) shall not exceed Hydraulic Institute levels as described in ANSHI/HI 9.6.4-2016 titled American National Standard for Rotodynamic Pumps for Vibration Measurements and Allowable Values. These limits shall be acceptance tested per HI 9.6.4 – Section 9.6.4.2.4.4.

      The allowable field vibrations for acceptance testing shall be as per Figure 9.6.4.2.5.1a, - Allowable pump vibration, pump types BB and OH. The figure is apart of Section 9.6.4.2.5.1 - Allowable pump bearing housing vibrations.

C. After completion of the installation, the equipment shall be field tested to demonstrate compliance with the specified performance requirements. Equipment supplier to provide within their price all labor and effort to support Pre-operational check out, Functional Testing, and Start-Up Testing as specified in Section 01 45 20.

3.03 TRAINING

A. Training shall be provided as specified in 01664 – Training.

B. A minimum of twelve (12) hours of total training shall be provided.
   1. The twelve (12) hours of training shall be comprised of the following
   2. Operations Training: Two (2) sessions, two (2) hours per session.

3. Maintenance Training: Two (2) sessions, four (4) hours per session.

C. Upon completion of the training activities, the Manufacturer shall provide an executed Instruction Certification Form 11000-B.

D. The Supplier's representative shall provide one additional (4-hour) day on-site as part of a separate trip at the time of start-up to provide startup support and furnish additional training of the Owner's personnel in the operation and maintenance of the equipment.

3.04 WARRANTY

A. Refer to Section 1.09.

END OF SECTION

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SECTION 13300
PRECAST CONCRETE BUILDING

PART 1–GENERAL

1.01 DESCRIPTION

This section specifies modular precast concrete buildings and related materials. The building shall be designed, supplied and erected complete by the precast concrete building manufacturer (Manufacturer) and shall conform to the requirements of the Florida Building Code (FBC) and these Specifications. Manufacturer shall act as a subcontractor to the General Contractor (Contractor) for this project. Contractor shall prepare the subgrade, install concrete encased electrical duct banks and piping runs under the building and provide the cast-in-place concrete foundation slab as shown on the Contract Drawings. In addition, Contractor shall install equipment pads, housekeeping pads and all equipment inside the building.

The building to be supplied is a new Electrical Building for the Manatee County Existing Master Lift Station (MLS) N-1B. .

The building supplied under this specification shall be 24'-0" long by 14'-0" wide with an interior height of 12'-0". . These measurements are for the concrete elements and do not include the reduction for insulated walls and ceiling. Building shall be integral without floor slab and anchorage for building shall be provided by building manufacturer. Precast building shall be modular building with dimensions as shown on the drawings. Precaster to determine actual panel size based on shipping, fabrication, access and design restrictions. Contractor to field assemble modular units on site. Final building assembly shall be weatherproof.

1.02 QUALITY ASSURANCE

A. Quality Control By Contractor

1. LABORATORY:

To demonstrate conformance with the specified requirements for precast concrete, the Manufacturer or the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329. The testing laboratory shall sample and test concrete supplied for the building. Costs of testing laboratory services shall be borne by the Manufacturer or the Contractor and at least three (4) sets of cylinders shall be cast and tested for this project to demonstrate "in-place" 28-day compressive strength.

2. CERTIFICATION:

The Contractor shall provide certification from the Manufacturer that the materials and construction of the precast work supplied conforms to these Specifications. The certification shall be signed by an officer of the Manufacturer's corporation.

The responsibility for furnishing and installing precast concrete conforming to the Specifications is solely that of the Contractor.

3. MANUFACTURER'S ENGINEER:

The Manufacturer shall employ or contract for the services of an engineer structural who is a registered Professional Engineer, licensed in the State of Florida. The design and shop drawings for the building shall be prepared by this same engineer.

4. MANUFACTURER'S WELDING INSPECTOR

The Manufacturer shall employ or contract for the services of a Certified Welding Inspector to do a final inspection of all welded connections performed on the building and provide a written inspection report. The inspection report shall be an attachment to the Manufacturer's Certification listed above.

5. MANUFACTURER'S QUALIFICATIONS:

The Manufacturer shall have been regularly engaged for at least five years in the manufacture and erection of precast structural concrete similar to the requirements of this project. The Contractor shall provide certification from the Manufacturer that the minimum experience requirement conforms to these Specifications. The certification shall be signed by an officer of the Manufacturer's corporation.

6. MANUFACTURER'S WARRANTY:

The precast concrete manufacturing plant shall be certified by the Precast-Prestressed Concrete Institute (PCI) Plant Certification Program prior to the start of production.

The Manufacturer shall warrant their work against leakage for a period one year following final acceptance of the project by the Owner. Leakage shall constitute proof of noncompliance with this Specification and shall be repaired immediately at the Contractor's expense to the satisfaction of the Owner.

B. REFERENCE STANDARDS:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ACI 301	Specifications for Structural Concrete for Buildings
ACI 318	Building Code Requirements for Structural Concrete
ASTM E329	Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs Type 316
ASTM F594	Standard Specification for Stainless Steel Nuts Type 316
DCA	Florida Department of Community Affairs
FBC	Florida Building Code - Latest Edition

1.03 SUBMITTALS

In accordance with specification Section 01300 and in addition to the requirements of that section, the following submittals shall be provided:

A. Specification Section

A copy of this 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. Concrete Mix

Prior to casting any precast elements, the concrete mix design shall be submitted to the Construction Manager for acceptance.

C. Shop Drawings

Shop drawings to include, but not be limited to, the following:

1. Plans and elevations locating and defining all materials furnished by the Manufacturer, including blockouts and penetrations.

2. Sections and details showing structural steel connections (embeds), cast-in-items such as lift points, wall and ceiling insulation, door details and their

relationships within the building structure.

3. All final shop drawings (plans, elevations, section and details) shall be signed and sealed by the Manufacturer's structural engineer.

4. Description of all loose, cast-in and field hardware.

5. Description and cut sheets of all materials or products listed in section 2.03.

6. Erection sequences and handling requirements.

7. All FBC required Notices of Acceptance (NOA) and all DCA approvals.

8. Submit for record purposes only, design calculations including anchorage for precast building to foundation signed and sealed by a registered Professional Engineer, licensed in the State of Florida and experienced in precast concrete design. Design loading conditions shall be as indicated in this section or as noted on the Contract Drawings.

D. Test Reports

1. Certified tests as required for reinforcing steel and concrete materials.

2. Furnish three (3) copies of reports covering test results.

1.04 HANDLING AND STORAGE

Unless specified otherwise herein, fabrication, handling and erection of precast elements shall be in accordance with the recommendations made by ACI 301 and ACI 318. Under no circumstances shall the precast components be shipped until 7 days of curing has occurred.

Precast elements shall be properly supported off the ground to avoid damage during curing, storage, handling and hauling. Lateral support shall be sufficient to prevent cracking, bowing, warping, or permanent set due to creep. Edges of the units shall be adequately protected by padding or other means to prevent staining, chipping or spalling of concrete. Lifting devices shall have a minimum safety factor of 4.

1.05 INSPECTION

The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and review by the Construction Manager. Such inspection may be made at the place of manufacture, or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time for failure to meet any of the Specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job site at once. All sections which have been damaged after delivery will be rejected, and if already installed, shall be repaired, or removed and replaced, as directed by the Construction Manager, entirely at the Contractor's expense.

At the time of inspection, the sections will be carefully examined for compliance with the Specifications, and with the approved Manufacturer's drawings. All sections shall be inspected

for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

Imperfections may be repaired, subject to the approval of the Construction Manager, after demonstration by the Manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance.

PART 2–PRODUCTS

2.01 ACCEPTABLE PRODUCTS

Acceptable building Manufacturers are AES Precast Company, Inc., Concrete Modular Systems, Inc., Oldcastle Precast, Inc., Gates Precast, or approved equal.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. GENERAL:

This Section includes criteria for designing, handling, delivering, and installing a modular precast concrete building as indicated. The structure shall be constructed of reinforced concrete, and shall be designed to meet the following requirements using the most restrictive:

1. FBC, latest edition.

2. The building shall be designed for the following minimum loadings, unless the above referenced code is more restrictive:

   a. Roof Live Load - 30 psf.

   b. Floor Live Load - 300 psf.

   c. Floor Dead Load - 75 psf.

   d. Wind Load – see contract drawings.

   e. Electrical cable tray loading as shown in Electrical drawings for cable tray mounted to walls and ceiling. Contractor is required to coordinate cable tray support locations, attachment(s) with electrical contractor/designer and precast building manufacturer.

B. The building shall be designed in accordance with ACI-301 and ACI-318. The floor and roof shall be designed for the clear span indicated on the drawings without the use of interior supporting members. The interior finished clear height shall be not less than 12'-0" (concrete to concrete).

C. The building shall be constructed of precast sections which are shop or field assembled using structural steel connections. Building segments shall be fully monolithic castings, partially monolithic castings or segmented panels. Regardless of Manufacturer's standard forming system, all building elements shall be securely fastened together with welded or bolted steel plates or angles that are either embedded in the precast concrete or shipped loose. The use of epoxy doweled connections will not be accepted. Joints shall be caulked with a material selected by the

Manufacturer to maintain a permanent seal under severe weather and handling conditions.

D. Roof joints shall be caulked with a sealant or sealed with membrane roofing strips as selected by the Manufacturer. The thickness and width of the roofing strips shall be selected by the Manufacturer for the application and shall be cemented to the concrete with a compound designed for that purpose, and shall be sloped for drainage. Roofing strips shall be compatible with membrane roofing system. The sealant or roofing strips shall be applied to “dry-in” the building at an early stage of construction before the final roofing material is installed. The membrane roofing system is specified herein and shown on the Contract Drawings.

E. The building shall be assembled, sealed, waterproofed, and tested for watertightness at the Manufacturer's plant or on site. All wall and slab joints shall be caulked with a sealant selected by the Manufacturer for the application and concrete on interior surfaces smoothed to remove projections.

F. Coordinate the location and size of all door and louver openings.

G. Coordinate the location and size of all openings for mechanical and electrical and control equipment.

2.03 PRECAST CONCRETE BUILDING MATERIALS

A. Reinforcing Steel

Reinforcing steel shall be as specified on the Contract Drawings.

B. Concrete

Concrete shall be as specified on the Contract Drawings. The minimum 28-day compressive strength shall be 5,000 psi.

C. Concrete Slab Surface Sealing

The floor slab shall receive the Manufacturer’s standard curing and sealing compound to dustproof the concrete surface.

D. Interior Wall And Ceiling System

The building interior wall and ceiling treatment shall be the Manufacturer’s standard products but shall consist of galvanized steel furring, insulation and drywall finished with latex paint. The building insulation shall be rigid foam board with a minimum of R-18 on the walls and R25ci on the ceiling with an appropriate vapor barrier. In addition, this interior wall and ceiling treatment should permit the concealed installation of internal building electrical and control systems as outlined in Division 16.

E. Roofing

Roofing shall be a fully adhered membrane by Sarnafil, or equal with painted aluminum flashing as specified on the Contract Drawings.

F. Sealants

Sealants shall be the Manufacturer's standard.

G. Doors

Doors shall be the Manufacturer's standard aluminum doors and frames as specified on the Contract Drawings with current NOA. Anchors for frames shall be Type 316 stainless steel with the size and quantity as listed on the NOA.

H. Finish Hardware

Finish hardware shall be the Manufacturer's standard stainless steel hardware and shall include the following: ADA full mortise lock sets with lever handles keyed to Owners requirements (CyberLock® System is required for all lock sets on the project, Part Number: CL-6P1, One Master Key shall be provided by the Contractor for use during construction and shall be delivered to the Owner upon completion of the project. Three new Cyberkeys shall be provided to the Owner. Contractor shall coordinate programming of the lock cylinders with the County's Communicator system prior to installation); 5-knuckle ball bearing hinges 2 pair of butts per leaf on 7-foot 10-inch doors; interior 10-inch high kick plate; and panic hardware on the single leaf doors and working leaf of double doors.

I. Door Accessories

Door accessories shall be Manufacturer's standard aluminum and neoprene items and shall include the following: ADA compliant threshold; automatic door bottom; jamb and head surface mounted weather stripping; split astragal and meeting stile weather strip for double doors; door closer; and drip cap.

J. Exterior Coating

The exterior of the building shall be coated with a semi-gloss acrylic paint. Acrylic coating shall be Devflex 4206QD by Devoe, DTM Acrylic by Sherwin-Williams, Series 6 Tneme-Cryl by Tnemec, or equal. Color shall be selected by the Owner. Coating shall include filler surfacer as recommended by the coating manufacturer, primer and two coats at minimum of 3 mils DFT each.

K. Warning Signs

Warning signs shall be provided for accident prevention, hazard communication, exits, and fire extinguishers. Governing criteria shall be OSHA Standard 29CFR and NFPA 704 as applicable and as determined by the local fire marshal.

L. Fire Extinguishers

Fire extinguishers shall be as listed on the Contract Drawings.

M. Mechanical and Electrical Construction

Mechanical and electrical construction shall be as specified in Divisions 15 and 16.

N. Embedded Items and Anchorage Devices

All embedded items, inserts, and anchorage devices exposed to view, moisture or weather shall be hot-dipped galvanized steel. All weldments shall be plain steel and coated with epoxy paint after installation of welds and inspection. Epoxy coating shall be Series 69 High-Build Epoxoline II by Tnemec, or equal.

O. Penetrations

All required penetrations and openings larger than 6-inches in diameter or 6-inches square shall be formed in place at the time of casting. Additional reinforcing steel shall be added where required to meet loading requirements. Openings and penetrations smaller than 6-inches may be core drilled. There shall be no penetrations of conduit or piping through the cast-in-place concrete foundation within 9" clear of a structural steel embed required to erect the precast panels or within 9" of the outside edge of the wall panels.

P. Molds

Material from which molds are to be fabricated shall be steel, concrete, fiberglass, reinforced plastic or wood. The selection of materials for molds shall be at the Manufacturer's option, except that wood shall not be used without the express approval of the Construction Manager. All elements shall be cast in molds of rigid construction, accurate in detail with precise corners and arises, and designed to provide a close control of dimensions and details as indicated on the drawings. Exterior finish shall be as indicated on the drawings. Interior finish shall be smooth.

Prior to casting of precast elements, molds shall have all surface joints, radii, corners, etc., filled, ground, filed, straightened or otherwise removed to provide a finished concrete surface that is smooth and dense, free of honeycombing, large air pockets, offsets, sinkages, or other irregularities.

Q. Parting Compound

All molds shall be coated with parting compound to facilitate removal of elements from molds. Parting compound shall be non-petroleum, nonstaining and shall be of a nature and composition not deleterious to concrete.

PART 3–EXECUTION

3.01 INSTALLATION

A. General

Prior to installation of the building shell, the Contractor shall perform the following work: prepare and proof roll subgrade; install all below grade concrete encased conduits and piping, extending them above finished floor grade; provide select compacted fill; and place cast-in-place concrete foundation slab. Contractor shall control installation of conduits and piping such that the installed facilities will conform to openings in the modular precast units.

As previously stated, building can be assembled at the place of manufacture or on-site. Construction of the building shell shall include all materials and accessories listed above. The Contractor shall then field install all related materials, accessories and equipment as specified in other Divisions of these Specifications for a complete functioning building.

B. Manufacturer's Field Service

1. Manufacturer's representative shall be present during delivery and unloading and installation of the building. Set building according to Manufacturer's recommendations, and as required by Manufacturer's representative. If building is site assembled, Manufacturer's representative shall be present during assembly sealing, waterproofing and testing for watertightness as well as installation of final roofing membrane and application of final exterior coating.

C. Casting

Casting shall be accomplished by methods and equipment that are in conformance with generally acceptable systems for this type of Work. All precast concrete shall be manufactured by a plant thoroughly experienced in this type of Work. The Manufacturer shall meet all production schedules. Surfaces on which units are cast shall be level and free from any imperfections detrimental to the surface appearance of the finished units. Parting compound shall be applied evenly as per Manufacturer's recommendations.

D. Welding and Coating Of Steel Embeds

All weldments shall be made in accordance with the applicable provisions of AWS. All welding, other than tacks, shall be done by certified welders. All units shall be protected from damage by field welding or cutting operations. Noncombustible shields shall be provided as necessary for this purpose. Contractor shall retain the services of a Certified Welding Inspector to inspect final welds at the place of manufacture or on-site prior to covering any of the work. A report of the weld inspection shall be provided to the Construction Manager and the Owner. Following acceptance, all weldments shall receive surface preparation, primer and shall be painted with two coats of epoxy at 5.0 mils DFT each coat (10.0 mils DFT). Follow coating manufacturer’s written instructions on surface preparation, primer and installation.

E. Joints And Joint Sealants

In all instances, the edges of precast concrete units and of adjacent material shall be sound, smooth, clean and free of all contaminants prior to joint treatment.

Sealant and primer shall be supplied by the same manufacturer and the primer, when required, shall be as recommended for the particular sealant used. All sealant compounds shall be delivered to the job in the manufacturer's original sealed containers with labels intact and shall be applied in strict accordance with the manufacturer's recommendations.

3.02 CLEANING AND REPAIRING

After installation, precast elements shall be protected from all damage until final acceptance by the Construction Manager. Precast units with cracks, spalls, and other defects shall be subject to rejection. Units reviewed for repair shall be repaired to the satisfaction of the Construction Manager prior to final exterior coating. This repair shall include application of any filler/surfacer at bug holes or surface defects that may be required to provide a uniform concrete finish prior to final coating.

3.03 FINAL EXTERIOR COATING

After installation of all components, the exterior of the building shall receive surface preparation, filler/surfacer, primer and shall be painted with two coats of acrylic at 2.5 mils DFT each coat (5.0 mils DFT). Follow coating manufacturer's written instructions on surface preparation, filler/surfacer, primer and installation of finished coats.

END OF SECTION

SECTION 13350A WET WELL CLEANING

PART 1 GENERAL

1.01 SCOPE

A. Description

The Contractor shall provide the necessary labor and equipment for the removal of waste generated from Sanitary Sewage Lift Station Wet Wells.

B. Work Included

The successful bidder will provide services for the “total elimination” of the waste within the wet well. Cleaning shall include stopping the flow into the station, the physical removal of all floating material, grease/oil, organic compounds, bottom sediment, grit, and materials that have collected on the walls, floor, and all other extraneous materials within said wet wells, are cleaned from the lift station structure and all items within. Vacuum Trucks with the ability to remove the sludge, dirt, grease, etc. from the interior walls and bottom of the wet well.

1.02 EQUIPMENT

A. All cleaning machines must be capable of efficient, reliable operation. A high-pressure water washing or wet abrasive sand blasting, use 3000-psi water pressure, minimum. Remove dirt, oil, loose concrete, any previously applied coatings (except liners) or other deleterious materials.

1.03 CLEANING

A. Continue the cleaning procedures using pressure washing and/or mechanical methods until a uniform and sound profile is obtained. All contractors shall be expected to have and make available extension equipment on an as needed basis in order to properly clean deeper basins. Actual operation of equipment may need to be witnessed/verified by the inspector upon and prior to awarding a purchase order for this requirement.

B. The Removal and Disposal of all material from the Wet Wells is the responsibility of the Contractor. The cost for this shall be included in the bid price. No dumping or stock piling of these materials will be allowed at any of the lift stations.

C. The Contractor is fully responsible for compliance with all Federal, State, and local laws, including but not limited to the OSHA Confined Space Entry regulations.

D. Existing liner, control floats and/or pressure or level transmitters located in each wet well must be protected from damage by the Contractor during his/her operations. Any damage done to the liner, floats and/or pressure transmitters must be immediately repaired by the Contractor at his/her expense.

E. Some of the wet wells are configured to allow for direct vertical access; some will require flexible suction lines and/or bends. The Contractor must remove and replace grating in the wet wells to allow for complete and total access to all areas of the wet wells for the removal of grease, grit, and other material. No additional compensation will be allowed for special piping, rigging, etc. required to complete the work.

F. See Contract Drawings for the approximate dimensions of wet well as well as for the Coating repair notes.

G. Each lift pump station is considered to be a locked, secure facility. Access will need to be arranged through the Wastewater Superintendent accordingly.

H. The Contractor, at his/her sole risk, may store his/her equipment at the lift stations during the project. Insurance for said equipment will be the responsibility of the contractor/equipment owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 15500 AIR CONDITIONING SYSTEM

PART 1 GENERAL

1.01 SCOPE

Furnish and install a complete air conditioning system for climate control. The system shall be two (2) ductless three-ton high efficient air conditioning units manufactured by Mitsubishi/Trane or approved equal with a minimum SEER rating of 18.8. The system shall include all necessary components to insure a complete operable system, including:

- Two (2) outside condensing units
- Two (2) wall mounted inside evaporator units
- Necessary accessories, to be detailed in the Products section.
- Include Seacoast Protection per manufacturer's guidelines.

1.02 CODES AND STANDARDS

All work performed under this specification shall conform to the requirements of the latest edition of the following codes and standards as modified by local ordinances:

Reference	Title
AMCA	Testing and Rating Fans
ANSI B9.1	Construction Safety
ANSI/ASHRAE 62.1	Ventilation Design and Acceptable Indoor Air Quality
ANSI/ASHRAE 15-2010	Safety Standard for Refrigeration Systems
ANSI/NFPA 70	National Electric Code
AHRI 210/240	Unitary Air-Conditioning and Air-Source Heat Pump Equipment
AHRI 270	Sound Rating of Outdoor Unitary Equipment
AHRI 340/360	Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment
AHRI 410	Standard for Forced Circulation Air-Heating and Air-Cooling Coils
IBC	International Building Code
IMC	International Mechanical Code
NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
NFPA 90B	Standard for Installation of Warm Air Heating and Air Conditioning Systems
UL 1995	Heating and Cooling Equipment

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver all components in factory-fabricated protective containers.

B. Handle all components carefully to avoid damage to components, enclosures and finish. Do not install damaged components; replace and return damaged components to manufacturer.

C. Store all components in clean dry place and protect from weather and construction traffic.

1.04 SUBMITTALS

A. Thoroughly coordinated shop drawings shall be submitted for approval.

1. Submit shop drawings and complete performance data for all major pieces of equipment, showing dimensions arrangement, connection sizes, electrical wiring diagram, power requirements and clearances required for access of service. Shop drawings shall include factory certification that the equipment has the required capacity or shall include copies of manufacturer's published performance data.
2. Equipment proposed will require complete shop drawings, which clearly show how the equipment fits the available space and in relation to adjacent equipment, with all connections shown such as piping and duct work.
3. Provide submittal data for major component, air distribution devices, installation materials and duct work.
4. Submit for approval complete power and control field wiring diagrams.
5. Submit for approval a drawing indicating location and sizes of all wall penetrations and supports required for this work.

B. All shop drawings submitted for approval shall be stamped by the Contractor before submission to indicate that the shop drawings are complete, checked and comply with all aspects of the requirements of all Contract Documents.

C. Shop drawing approvals by the County will not relieve the Contractor from responsibility for his own errors, nor from his responsibility for full compliance with the Contract Documents.

D. All data and drawings shall be submitted simultaneously in an indexed booklet.

E. The units shall have a manufacturer's parts and defects warranty for a period five (5) years from date of installation. The compressor shall have an extended warranty of seven (7) years from date of installation.

1.05 OPERATING AND MAINTENANCE MANUALS

A. When the installation is completed, submit to the County, one copy of the following, bound in a hard cover booklet:

1. General operating instructions, including copies of posted specific instructions and automatic control diagrams.
2. Maintenance instructions, followed by tabulated manufacturer=s descriptive literature, shop drawings, performance curves and rating data, spare parts lists and manufacturer=s maintenance manuals.
3. Names, addresses and telephone numbers of local service representatives of the manufacturer=s of the installed equipment.

PART 2 PRODUCTS

2.01 EQUIPMENT BASIS OF DESIGN

A. Mitsubishi PKA-A36KA7 Wall Mounted Evaporator with PUY-A36NKA7(-BS) Condensing Unit

2.02 OUTSIDE CONDENSING UNIT

A. Provide factory assembled self-contained, air cooled condensing unit, complete with

compressor section, integral condenser, all necessary controls and interconnecting refrigerant piping. Furnish manufacturer's five (5) year parts and labor warranty for motor compressor.

B. All components shall be protected against corrosion and shall be mounted in a steel casing of a minimum of 14-gauge panels with steel angle framing and adequate access panels for inspection and maintenance.

C. Provide all piping, valves, and fittings required to properly interconnect all system components.

D. Tubing for coils shall be copper; fins shall be aluminum.

E. The outdoor unit and condenser coil shall include a corrosion resistant coating suitable for coastal environments.

2.03 INSIDE AIR HANDLER/EVAPORATOR UNIT

A. Casing walls shall be fabricated of continuous galvanized steel and coated with baked enamel finish not lighter than 18 gauge. Removable panels shall provide access to the interior of the unit.

B. Fan and coil sections shall be internally insulated with 1-inch thick, 3 lb. density neoprene coated fiberglass. Insulation shall be secured to the casing with waterproof adhesive and permanent fasteners.

C. Fan wheel shall be forward curved type, non-overloading, and keyed to the shaft. Fan wheel shall be dynamically and statically balanced at factory.

D. V-belt driven fan shall be designed for 50 percent overload capacity.

E. Bearings shall be designed for a minimum of 200,000 hours average life.

F. Coil section shall encase cooling coils and drain pan. Coils shall be arranged for horizontal air flow. Coil headers, valves and all piping shall be completely enclosed within the insulated casing.

G. Tubing for coils shall be copper. Fins shall be aluminum.

H. Drain pan shall be galvanized steel, with a heavy coat of mastic.

I. Drain pan shall include a level sensor and emergency overflow shutdown controls.

J. Filter Section: Filter section shall be designed to hold throwaway filters.

2.04 ACCESSORIES

A. Piping Line Set
B. Electrical Disconnect
C. Wall Mounting Bracket
D. Condensing Unit Mounting Pad

2.05 TEMPERATURE CONTROLS

A. Furnish and install a wired, wall mounted temperature controller.

PART 3 TESTING AND BALANCING

A. The Contractor shall test and balance the air conditioning system.

B. The term Aair conditioning systems@ shall be understood and intended to mean all air conditioning supply systems, and all associated equipment and accessories.

PART 4 EXECUTION

4.01 GENERAL

A. Install the air conditioning system where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordinate with other work, including plumbing, ceiling and truss construction, roof decking, electric, piping, and overhead crane system as necessary to interface installation of air handling units with other work.

C. Install air handling unit on vibration mounts and comply with manufacturer's indicated installation method.

D. Spare Parts:

1. Provide one complete extra set of filters for the air handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting and balancing work.
2. Provide one spare set of belts for the air handling unit.

4.02 INSTALLATION

A. Air-Cooled, Compressor-Condenser
1. Mounted on pad.
2. Install according to manufacturer's guidelines for maintenance clearances.

B. Wall-Mounted, Evaporator-Fan
1. Mounted on a wall bracket.
2. Install according to manufacturer's guidelines for maintenance clearances.
3. Mount in accordance with NEC.

C. Refrigerant Lines:
1. Route pre-insulated line set between condensing and evaporating units.
2. Route line set to avoid tripping hazards.
3. Seal wall penetrations watertight.

D. Condensate Drain
1. Route to gravel pit adjacent to building.
2. Drain must not deposit condensate on concrete walkways. If there is no gravel available for draining condensate immediately adjacent to the building, the drain must be routed to an acceptable area.

E. All major components shall be rigidly and strongly supported with suitable braces, tees, or angles to keep them true to shape and prevent buckling.

F. Pocket joints or bar slips, if used, must be riveted at the corners. Approved means must be provided to prevent pocket and slip joints pulling apart such as riveting on 12-inch centers, clip punching on 8-inch centers or button pressing on 4 inch centers. Sheet metal screws puncturing ducts will not be allowed in the construction of seams and joints.

G. Sealing and Leak Testing: All seams, joints, gaps, holes, etc. in the ductwork shall be sealed with mastic and checked for airtightness before insulation is applied.

END OF SECTION

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SECTION 16000 GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

B. DEFINITIONS:

1. ELEMENTARY OR SCHEMATIC DIAGRAM: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

2. ONE-LINE DIAGRAM: A one-line diagram shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

3. BLOCK DIAGRAM: A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

4. WIRING DIAGRAM OR CONNECTION SYSTEM: A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram shall be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) a panel layout diagram showing the physical location of devices plus the elementary diagram.

5. INTERCONNECTION DIAGRAM: Interconnection diagrams shall show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable.

   Each wire identification as actually installed shall be shown. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification.

All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Wires or jumpers shown on the equipment connection diagrams shall not be shown again on the interconnection diagram. Signal and DC circuit polarities and wire pairs shall be shown. Spare wires and cables shall be shown.

6. ARRANGEMENT, LAYOUT, OR OUTLINE DRAWINGS: An arrangement, layout, or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI A58.1 / ASCE 7	Minimum Design Load in Buildings and Other Structures, 1982
ANSI C80.1	Rigid Steel Conduit - Zinc Coated, 1994
ASTM B3	Standard Specification for Soft or Annealed Copper Wire, 2001
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, 1999
ASTM B33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes, 2000
ICEA S-68-516 / NEMA WC 70, 71, & 74	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
ICEA S-95-658	Standard for Non-Shielded Power Cables Rated 2000 Volts or Less, 2000
IEEE 81	Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, 1983

Reference	Title
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations, 1974 (1992)
JIC EMP-1	Electrical Standard for Mass Production Engineering, 1967
NEMA TC2	Electrical Polyvinyl Chloride (PVC) Conduit, 2003
NEMA 250	Enclosures for Electrical Equipment (1000 Volt Maximum)
NEMA WC-70	Non-Shielded Power Cable 2000V or Less (ICEA S-95-658), 1999 (2001)
NEMA WD-1	General Requirements for Wiring Devices, 1999
NFPA 70	National Electrical Code (NEC)
UBC	Uniform Building Code
UL 6	Electrical Rigid Metal Conduit - Steel, 12th Edition, 2000 (2003)
UL 44	Thermoset-Insulated Wires and Cables, 15th Edition, 1999 (2002)
UL 67	Panelboards, 11th Edition, 1993 (2003)
UL 83	Thermoplastic-Insulated Wires and Cables, 13th Edition, 2003 (2004)
UL 263	Fire Tests of Building Construction and Materials, 13th Edition, 2003
UL 360	Liquid-Tight Flexible Steel Conduit, 5th Edition, 2003
UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, 10th Edition, 2002 (2003), Adopted: NEMA AB 1-1999
UL 1277	Electrical Power and Control Tray Cables with Optional Optical-Fiber Members, 4th Edition, 2001 (2003)

B. IDENTIFICATION OF LISTED PRODUCTS:

Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority, to undergo inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

C. FACTORY TESTS:

Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

1.03 SUBMITTALS

The following submittals shall be provided in accordance with Section 01300:

1. A copy of this 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, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

   Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Catalog cuts of equipment, devices, and materials requested by the individual specification sections. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

   Catalog cuts shall be assembled in a folder. Each folder shall contain a cover sheet, indexed by item, and cross-referenced to the appropriate specification paragraph.

3. Interconnection diagram: The Contractor shall prepare interconnection diagrams depicting all cable requirements together with their actual terminations as specified in paragraph 16000-1.01 B.

4. Conduit layout drawings indicating size, location, and support, for all conduits other than single runs of 1-inch diameter or less cast in concrete construction.

   a. Conduit layout drawings shall illustrate a system which conforms to the requirements of paragraph 16000-3.01-B.

   b. For layouts that do not conform to 16000-3.01 B, provide engineering design and calculations signed and sealed by a Professional Engineer registered in the state of the project. Engineering design and calculations shall demonstrate that the proposed layout does not impair or significantly reduce the design structural strength.

5. Safety disconnect switch list including legend with equipment tag, equipment description, and power feeder circuit source and location information.

1.04 DRAWINGS

Prepare specified drawings on 11-inch by 17-inch drafting media complete with borders and title blocks clearly identifying project name, equipment, and the scope of the drawing.

Prepare drawings to reflect the final constructed state of the project installation or supplied equipment. Provide drawing quality, clarity, and size of presentation to permit insertion in operation and maintenance manuals.

1.05 PROJECT/SITE CONDITIONS

A. GENERAL:

Unless otherwise specified, equipment and materials shall be sized and derated for the ambient conditions specified in Section 01800, but not less than an ambient temperature of 40 degrees C at an elevation ranging from sea level to 3000 feet without exceeding the manufacturer's stated tolerances.

B. CORROSIVE AREAS:

The following areas are designated as corrosive:

1. Areas within Pump Vault
2. Pump Room
3. Outdoor areas

C. HAZARDOUS (CLASSIFIED) AREAS:

The following areas are designated as hazardous (classified) in accordance with the NEC:

1. Areas within Pump Vault and Wetwell

D. SEISMIC:

Electrical equipment, supports, and anchorage shall be designed and installed in accordance with the seismic design requirements specified in Section 01900 and applicable building codes.

1.06 STORAGE OF MATERIALS AND EQUIPMENT

Store equipment and materials in the factory-sealed container and protect with additional covering and materials to avoid physical damage or weather damage.

1.07 ELECTRICAL NUMBERING SYSTEMS

A. RACEWAY NUMBERS:

1. Tag raceways with brass tags at the access locations including manholes, pull boxes, junction boxes, and at the terminations.
2. Tag raceways with aluminum tags where subject to hydrogen sulfide atmosphere typically found at wastewater treatment facilities.
3. Raceway numbers are derived from the “Cable and Conduit Schedule” or the ductbank cross-sections. Where raceway numbers are not provided, use the circuit number on the power and control single line diagrams.

B. CONDUCTOR NUMBERS:

1. Identify wire and cable circuit numbers at both ends. Refer to the circuit labeling method specified and shown in the drawings to label circuits.
2. Identify lighting and receptacle branch circuits with the power source and circuit load, at source and destination locations. Identify the load, location, and circuit in typed panel schedules with corrections shown.
3. Include copies of schematic diagrams, wiring connection diagrams, and interconnection diagrams inside of the equipment enclosure, protected in a plastic container in the equipment print holder.

1.08 ARC FLASH MITIGATION METHODS

The following mitigation method requirements shall apply to all power distribution and utilization equipment supplied for any products supplied on the project and applies to all equipment divisions in the Contract Documents. Refer to the NFPA-70 (NEC), and NFPA-70E (NESC) for equipment labeling requirements.

A. EQUIPMENT LABELS:

Equipment labels shall be installed on the outside of the electrical equipment enclosure, cabinet, and panels to avoid opening the equipment to access the manufacture's data or the equipment ratings.

B. HINGED DOORS:

Power distribution equipment shall have hinged rear doors where back access is shown.

C. REMOTE RACKING DEVICES:

Power distribution equipment shall have remote racking devices for Operators to insert or remove rack-mounted breakers, rack-mounted devices, or auxiliary equipment drawers into the associated equipment location.

D. INSULATED POWER BUS AND INSULATED CABLE BOOTS:

Provide insulated power bus in power distribution equipment where accessible to installers or maintenance workers.

Provide cable boots for power conductor connections to insulate the exposed power conductor connections.

E. VIEW WINDOWS FOR MONITORING:

Provide protected view windows into cabinets that allow infra-red analyzers, monitors, or cameras to monitor hot temperature for unusual heat generated by deteriorating connections. The view windows shall have a method to move the window protector and hold-in-place during the monitoring operation.

F. POWER AND CONTROL EQUIPMENT SEPARATION:

Provide separation between power equipment within an enclosure, cabinet, or panel by the uses of barriers, separate access doors, or by other means.

Provide separation barriers between main breaker feeders coming into equipment and other termination points or bussing on the load side of the main breaker.

G. AUTOMATIC SHUTTERS:

Provide automatic shutters, where possible, to close the access to the power bus when a power device is not engaged.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. GENERAL:

Equipment and materials shall be new and free from defects. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

B. EQUIPMENT FINISH:

Unless otherwise specified, electrical equipment shall be painted by the manufacturer as specified in Section 09900 - Coating Systems.

C. GALVANIZING:

Where specified, galvanizing shall be in accordance with Section 05910.

2.02 WIRE MARKERS

Each power and control conductor shall be identified at each terminal to which it is connected. Conductors size No. 10 AWG or smaller shall have identification sleeves. Conductors No. 8 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

Conductors shall be identified in accordance with paragraph 16000-1.07 B. Adhesive strips are not acceptable.

The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink with figures 1/8 inch high. Sleeves shall be yellow or white tubing and sized to fit the conductor insulation. Shrink the sleeves with hot air after installation to fit the conductor.

Conductor and Wire Marker Manufacture:
1. TMS Thermofit Marker System by Raychem Co
2. Sleeve style wire marking system by W. H. Brady Co.
3. or equal.

2.03 RACEWAY MARKERS

Raceway markers tags shall be:

1. Solid brass with 0.036-inch minimum thickness.
2. Raceway number stamped in 3/16-inch minimum height characters
3. Attached to the raceway with 316 stainless steel wire.

2.04 NAMEPLATES

Nameplates shall be made from laminated phenolic plastic.

1. Nominal size: 3/4 inch high by 2 inches long.
2. Black backgrounds with 3/16-inch white letters.
3. Fastened using self-tapping stainless steel screws.

Abbreviations shall be submitted to the Construction Manager prior to manufacture because of space limitations. Nameplate adhesives will not be permitted on the outside of enclosures.

2.05 TERMINAL BLOCKS

Unless otherwise specified, terminal blocks shall be panhead strap screw type. Terminals shall be provided with integral marking strips that permanently identify with the connecting wire numbers as shown on the drawings:

1. Terminal blocks for P-circuits (power 208-600 volts)
   a. Rated not less than the conductor current rating
   b. Rated less than 600 volts AC.
2. Terminal blocks for C-circuits and S-circuits:
   a. Rated not less than 20 amperes
   b. Rated less than 600 volts AC.
3. Terminals shall be tin-plated.
4. Insulating material shall be nylon.

2.06 PRODUCT DATA

The following information and product data specified under individual specification sections shall be provided in accordance with Section 01300.

1. Applicable operation and maintenance information on an item-by-item basis in accordance with Section 01730. Operation and maintenance information shall be provided at the time of equipment, device, or material site delivery, or at a certain stage of project completion as required by Section 01730, whichever is the earlier. Full-size drawings shall be reduced to 11 x 17 inches.
2. Test results for motors and electrical systems on the forms specified in Section 16030. A file of the original test results shall be maintained by the Contractor. Prior to acceptance of work, the resulting file shall be provided to the Construction Manager.
3. Description of functional checkout procedures specified under paragraph 16000-3.02 C shall be provided 45 days prior to performing functional checkout tests.
4. Record documents specified in Section 01720 and paragraph 16000-3.03.

PART 3 EXECUTION

3.01 GENERAL

A. CONSTRUCTION:

The work under Division 16 shall be performed in accordance with these specifications.

Refer to the National Electrical Contractors Association's (NECA) National Electrical Installation Standards (NEIS) for Standard Practices for Good Workmanship in Electrical Contracting (NECA-1) as a minimum baseline of quality and workmanship for installing electrical products and systems that defines what is meant by "neat and workmanlike" as required by the National Electrical Code Section 110-12. Specified requirements supersede NECA practices.

Electrical layout drawings are diagrammatic, unless otherwise detailed or dimensioned. The Contractor shall coordinate the location of electrical material or equipment with the work.

Major electrical openings may compromise the structural integrity of the slab and wall elements. Major electrical openings are defined as openings or penetrations greater than two times the wall thickness in any dimension, and include duct bank transitions into a building through structural elements. Major electrical openings shall be constructed according to standard details on the drawings, up to an opening dimension of three feet. For opening dimensions greater than three feet, construct walls and slabs as specifically detailed on the drawings for that case. Major electrical openings proposed by the Contractor shall be submitted to the Structural Engineer of Record for the project for review.

Minor changes in location of electrical material or equipment made prior to installation shall be made at no cost to the Owner.

B. CONDUITS IN CONCRETE CONSTRUCTION:

Conduits for power, control and instrumentation may be embedded in and pass through concrete construction subject to the limitations in this paragraph. Where concrete strength or serviceability requirements prevent the direct embedment of conduit, provide adequate support, bracing, and serviceability details:

1. Concrete strength shall not be impaired significantly by the embedment of conduits in or through structural sections.
2. Conduit layout shall conform to the requirements of ACI 318, Sections 3.3 – Aggregates and 6.3 – Conduits and Pipes Embedded in Concrete.
3. Conduits shall be treated similarly to reinforcing steel for purposes of clearance. In general, code sections require conduit spacing the greater of:
   a. 1.33 times the maximum concrete aggregate size, clear
   b. Three diameters center to center alternate spacing and layout shall be as reviewed and accepted by the Engineer.

4. Conduit and raceway penetrations through walls and slabs where:
   a. one side is a conditioned or an occupied space and the other side not, or
   b. one side has liquid or groundwater contact and the other not,
   shall be detailed and constructed to prevent liquid and moisture penetration through the wall or slab section for each conduit.

C. HOUSEKEEPING:

Electrical equipment shall be protected from dust, water and damage. Motor control centers, switchgear, and buses shall be wiped free of dust and dirt, kept dry, and shall be vacuumed on the inside within 30 days of acceptance of the work.

Before final acceptance, the Contractor shall touch up any scratches on equipment as specified in paragraph 09900-3.03 H.

Electrical equipment temporarily exposed to weather, debris, liquids, or damage during construction shall be protected as specified in paragraph 01605-3.0 F.

Provide 4-inch high concrete housekeeping pads for all floor standing equipment and conduit stub-ups, no exception.

Provide 3 ft wide safety rubber mat on all the switchgear and electrical equipment. The rubber mat shall be no less than 1/4 inch thick and shall comply with OSHA and IEEE for Type 2 insulation requirements.

D. ELECTRICAL EQUIPMENT LABELING

Electrical equipment shall have field marked signs and labeling to warn qualified persons of the potential electric arc flash hazards per NEC Article 110.16 Flash Protection.

Electrical equipment shall have NFPA 70E labels installed stating the results of the Arc Flash analysis specified in Section 16431 Short Circuit and Protective Device Coordination Study Report.

Electrical distribution equipment and utilization equipment shall be field labels to identify the power source and the load as specified. Refer to NEC Article 110.22 for Identification of Disconnecting Means installation criteria. Specific information is required such as the equipment tag number and equipment description of both the power source and the load equipment.

E. SAFETY DISCONNECT SWITCHES:

Heavy duty fused and non-fused disconnect switches with current range of 30 to 600 amperes shall be provided as shown on the drawings with the enclosure type matching the area rating. Provide lock-off provision for a hasp padlock. Provide visible knife blades through a cover viewing window. Provide shielded or insulated line terminals with quick-make / quick-break switch operator. Provide internal barrier kit for additional personnel barrier from accidental contacts with live parts. Provide a legend plate with equipment tag, equipment description, and power feeder circuit source and location identification.

Disconnects shall include one auxiliary contact that operates with the power switch blades. The auxiliary contact shall be wired as shown on the drawings for remote status monitoring of the disconnect position where shown or for disconnecting motor space heater where shown.

Fuse clips shall be Class R rejection type and sized for UL Class R, one-time, time-delay fuses. Fuse assembly shall have a minimum short circuit capacity of 100,000 amps symmetrical. Provide fuses as shown and one set of spare fuses with each switch.

F. MOTOR CONNECTIONS

Verify that the motors are purchased with the correct size motor termination boxes for the circuit content specified as shown on the power single line diagrams or submit custom fabrication drawing indicating proposed motor termination box material, size, gasket, termination kit, grounding terminal, motor lead connection method, and motor terminal box connection/support system. Verify the motor termination box location prior to raceway rough-in.

H. CONDUCTOR INSTALLATION

An enclosure containing disconnecting means, overcurrent devices, or electrical equipment shall not be used as a wireway or raceway for conductors not terminating within the enclosure. Provide wireways, raceways, termination boxes, or junction boxes external to the enclosure for the other conductors.

3.02 TESTING

A. GENERAL:

Prior to energizing the electrical circuits, insulation resistance measurements tests shall be performed using a 1000-volt megohmmeter to verify the conductor is acceptable for use on the project. The test measurements shall be recorded on the specified forms and provided in accordance with paragraph 16000-1.03.

B. INSULATION RESISTANCE MEASUREMENTS:

1. GENERAL: Insulation resistance measurements shall be made on conductors and energized parts of electrical equipment. Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, NEMA or ANSI standards for the equipment or material being tested, unless otherwise specified. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

   Insulation resistance measurements shall be recorded in a format similar to Form 16000-A, contained in Section 01999. Insulation with resistance of less than 10 megohms is not acceptable.

2. CONDUCTOR AND CABLE TESTS: The phase-to-ground insulation resistance shall be measured for all circuits rated 120 volts and above except lighting circuits. Measurements may be made with motors and other equipment connected. Solid state equipment shall be disconnected, unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.

3. MOTOR TESTS: The Installed Motor Test Form, 16000-B, specified in Section 01999, shall be completed for each motor after installation.

   Motors shall have their insulation resistance measured before they are connected. Motors 50 HP and larger shall have their insulation resistance measured at the time of delivery as well as when they are connected. Insulation resistance values less than 10 megohms are not acceptable.

C. PRE-FUNCTIONAL TEST CHECKOUT:

Functional testing shall be performed in accordance with the requirements of Section 16030. Prior to functional testing, all protective devices shall be adjusted and made operative.

1. Submit a description of the proposed functional test procedures prior to the performance of functional checkout.
2. Prior to energization of equipment, perform a functional checkout of the control circuit. Checkout:
   a. Energizing each control circuit.
   b. Operating each control device, alarm device, or monitoring device.
   c. Operate each interlock to verify that the specified action occurs.

Verify motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation or momentary energization.

3.03 RECORD DOCUMENTS

Contract documents shall be maintained and annotated by the Contractor during construction, including the record drawings specified in Section 01720 [and the following additional schedules, lists, and drawings:

1. Cable Schedule (16120, Part 3)
2. Raceway Schedule (16110, Part 3)
3. Interconnection Diagrams (16000, Part 2)
4. Original Submittal Drawings (16000, Part 1)]

END OF SECTION

SECTION 16030 ELECTRICAL ACCEPTANCE TESTING

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies the acceptance testing of electrical materials, power distribution and utilization equipment and circuits. Contractor shall provide all labor, tools, material, power, and other services necessary to provide the specified tests.

Electrical acceptance testing shall be performed by a third-party electrical testing company specializing on this type of work and in accordance with NETA. Submit qualifications/resume of the electrical testing company including testing equipment to be used for the Engineer review and approval.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NETA ATS	Acceptance Testing Specifications for Electric Power Distribution Systems
NFPA-70	National Electrical Code (NEC)

1.03 SUBMITTALS

Functional testing and checkout procedures and schedule shall be provided in accordance with Section 01300.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT AND MATERIALS

Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology and shall have a current sticker showing date of calibration,

deviation from standard, name of calibration laboratory and technician, and date recalibration is required.

2.02 PRODUCT DATA

In accordance with Section 01300, the Contractor shall submit the completed test report forms 16000-A and 16000-B as specified in Part 3 herein.

PART 3 EXECUTION

3.01 TESTING

A. GENERAL:

The following specified tests, including correction of defects where found and the subsequent re-testing, shall be completed prior to energization of the equipment or systems. Submit all completed test report forms in a 3-ring binder type notebook at the project Substantial Completion date.

A megohmmeter shall be used for insulation resistance measurements.

B. INSULATION RESISTANCE MEASUREMENTS:

1. GENERAL: Insulation resistance measurements shall be made on conductors and electrical equipment that will carry current. Minimum acceptable values of insulation resistance shall be in accordance with the applicable NETA-ATS, ICEA, NEMA, or ANSI standards for the equipment or material being tested. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

2. CONDUCTOR AND CABLE TESTS: The phase-to-ground insulation resistance shall be measured for all circuits 120 volts and above except lighting circuits. Measurements may be made with motors and other load equipment connected. Insulation resistance measurements shall be recorded in a format similar to Form 16000-A contained in Section 01999, and submitted for acceptance. Insulation with resistance of less than 10 megohms is not acceptable.

3. MOTOR TESTS: The Installed Motor Test Form, 16000-B, contained in Section 01999, shall be completed for each motor after installation and submitted for acceptance. All motors shall have their insulation resistance measured before they are connected.

   Motors 50 HP and larger shall have their insulation resistance measured at the time of delivery and when they are connected. Insulation resistance values less than 50 megohms are not acceptable.

   Verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation.

4. POWER DISTRIBUTION EQUIPMENT: Transformers, panelboards, and other power distribution equipment shall have their insulation resistance measured phase-to-phase and phase-to-ground.

5. POWER UTILIZATION EQUIPMENT: Test receptacles and power outlets using a device to verify polarity, grounding, and the correct wiring connections.

C. FUNCTIONAL TESTING:

Contractor shall submit a description of proposed functional test and checkout procedures conforming to the following requirements, including a schedule for conducting these procedures, not less than 30 days prior to the performance of functional testing.

Prior to functional testing, all protective devices shall be adjusted and made operative.

Prior to energization of associated equipment, perform a functional checkout of all electrical and instrumentation control circuits as specified in the following and in Division 17. Checkout shall consist of energizing each control circuit and operating each control, alarm, safety device, and each interlock, in turn, to verify that the specified action occurs.

END OF SECTION

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SECTION 16110 RACEWAYS, BOXES, AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE

This section covers the furnishing and installation of electrical conduits, wireways, pull boxes, manholes, handholes, cable trays, fittings and supports. Raceways shall be provided for lighting, receptacles, power, control, instrumentation, signaling and grounding systems.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
JIC EMP-1	Electrical Standards for Mass Production Equipment
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA VE1	Cable Tray Systems
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NFPA 70	National Electrical Code (NEC)

NFPA 79	Electrical Standards for Industrial Machinery
IBC	International Building Code
UL 1	Flexible Metal Electrical Conduit
UL 6	Rigid Metal Electrical Conduit
UL 360	Liquid Tight Flexible Electrical Conduit
UL 514	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
UL 651	Rigid Nonmetal Electrical Conduit
UL 797	Electrical Metallic Tubing
UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
UL 884	Underfloor Raceways and Fittings
UL 886	Outlet Boxes and Fittings for Hazardous (Classified) Locations

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

A. PRODUCTS:

1. A copy of this 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.

   A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. Manufacturer's descriptive literature for materials.

3. Certification that Contractor has been trained to work on PVC-coated conduit systems.

B. UNDERGROUND CONDUIT RACEWAY SYSTEM:

1. A copy of this specification section Part 3, 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. A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

2. A copy of the Electrical Standard Detail drawings applicable to underground conduit systems, boxes, and manholes; with addendum updates included, and all referenced and applicable sections, with addendum updates included, check-marked to indicate specification compliance or marked to indicate requested deviations from specified requirements.

3. Failure to include a copy of the marked-up specification sections and drawings, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Underground conduit raceway system drawings or sketches per paragraph 16110-3.02 C.

PART 2 PRODUCTS

2.01 RACEWAYS AND FITTINGS

General requirements for raceway materials specified in this section are listed in the RACESPECS sheets at the end of this section. The type of raceways and raceway fittings to be used for any given area and application shall conform to the requirements in this section.

2.02 BOXES, GUTTERS, TERMINAL CABINETS, MANHOLES, AND HANDHOLES

Provide Type 316L (low carbon), 317, or Type 316 stainless products where specified. Enclosure constructed of mild sheet steel shall be hot-dipped galvanized after fabrication. Hinges shall be continuous type and for NEMA-4X cabinets hinges shall be stainless steel.

Table A specifies the electrical enclosure material and rating for the location and application.

Table A

Location	Electrical Enclosure Material and NEMA Rating
Indoor: Architecturally Finished Area	NEMA 1: mild steel
Indoor: Electrical Room	NEMA 1: mild steel
Indoor: Process Areas	NEMA 4X: Stainless Steel

Indoor: Corrosive Area	NEMA 4X: **Stainless Steel**
Outdoor: Corrosive Area	NEMA 4X: **Stainless Steel**
Outdoor: Non-Corrosive Areas	NEMA 4X: **Stainless Steel or Fiberglass**
Corrosive Area (Hypochlorite)	NEMA 4X: Fiberglass
Corrosive Area (Polymer)	NEMA 4X: Stainless Steel
Hazardous Area: Class I Division 2	NEMA 4X: Stainless Steel
Hazardous Area: Class I Division 1	NEMA 7: Galvanized Malleable Iron or Aluminum

A. PULL BOXES AND WIRING GUTTERS:

Indoor boxes and enclosures larger than FD boxes shall be constructed of sheet steel and galvanized after fabrication. Outdoor boxes and enclosures shall be provided with neoprene gaskets on the hinged doors or removable covers. Box and gutter sizes, metal thickness, and grounding shall comply with the National Electrical Code. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 pounds, shall have a rigid handle. Covers larger than 3 x 4 feet shall be split.

B. TERMINAL CABINETS:

Terminal cabinets shall be provided with adjustable terminal strip mounting, back-panels for equipment mounting, print pockets in the doors, continuous door hinges, and three-point lockable latches. Terminal cabinets located indoors shall be NEMA 12. Terminal cabinets located outdoors and in corrosive areas shall be modified NEMA 4X with stainless steel door hinge, three-point latch, and filtered ventilation, if required. Terminal block shall conform to Section 16000.

C. MANHOLES:

Unless otherwise specified, manholes shall be precast concrete, 3000 psi strength at 28 days, with reinforcing with the manhole cover designed for H 20 bridge loading. Necking and shaft shall have 36 inch minimum clear opening.

Manhole dimensions shall be as shown on the drawings and where not shown shall be sized in accordance with the NEC. Manhole cover and frame shall be Class 30B gray cast iron per ASTM A48 with machine finished flat bearing surfaces. Manhole covers shall be engraved "ELECTRICAL".

Manholes shall be watertight. Exterior walls of manholes shall be provided with 6 mils of waterproof membrane, Sonneborn HLM 5000 Series, or equal. Manhole walls shall be provided with boxouts with waterstops on all sides of each boxout. Waterstops shall be as specified in the Cast-in-Place Concrete section.

Raceway duct entries shall be no less than 14 inches above floor and below ceiling. Raceway boxouts shall be sized to accommodate the penetrating underground duct banks. Raceways bell-ends shall be flush with the interior finished manhole wall. From each duct bank entry into the manhole, the continuous duct bank bare copper grounding conductor shall be supported and routed around the interior manhole walls and bonded together.

Floor shall slope to a sump pit with dimensions shown in the manhole detail or with a minimum of 18 inch length x 18 inch width x 12 inches depth.

D. HANDHOLES:

Handholes shall be precast concrete with checker plate, galvanized, traffic covers designed for H 20 loading. Handholes shall be provided with precast solid concrete slab bottoms with sumps. Handholes shall be constructed of 3000 psi reinforced concrete. Handhole cover shall be engraved "ELECTRICAL" or "SIGNAL" as applicable.

Dimensions shall be as specified on the drawings. Handhole walls shall be provided with boxouts, as specified for manholes.

E. MANHOLE AND HANDHOLE CABLE SUPPORTS:

Provide heavy-duty, non-metal cable racks for support of conductors. Racks shall be UL listed glass-reinforced nylon consisting of slotted wall brackets for support arms designed for a minimum of a 400-pound load. Each support bracket shall from the top to the bottom and the arms shall be adjustable and installed on 24-inch centers. Use ½-inch stainless steel bolts, hardware, inserts, and fasteners. Cables supports, clamps or racks shall be provided to support the cable at minimum 2 foot intervals. Concrete inserts shall be embedded on 24-inch centers in walls and ceiling.

Cable Support Products or equal:

1. Underground Devices Incorporated Type RA arms with CR36 support brackets.

2. Unistrut Power-Rack F20N-STA33 Stanchions with F20N-ARM14 Arms.

F. GROUND BUS:

Provide a ground bus in concrete manholes, handholes, and electrical pullboxes with dimension of 3-foot width x 3-foot length x 3-foot depth and larger. Provide a NEMA threaded 4-hole grounding plate for connecting two to four-1-hole ground connectors that enter the enclosure from two to four duct banks. Products: Burndy, T&B, or equal.

2.03 RACEWAY SUPPORTS

A. CONDUIT SUPPORTS:

Framing channel with end caps and straps shall be provided to support groups of conduit. Individual conduit supports shall be one-hole pipe straps used with clamp backs and nesting backs where required. Material as specified herein.

Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated rigid steel clamps or oversized stainless steel clamps.

B. CEILING HANGERS:

Ceiling hangers shall be adjustable steel rod hangers and fittings. Provide J-Type conduit support for single conduit. Straps or hangers of plumber's perforated tape are not acceptable. Unless otherwise shown, hanger rods shall meet ASTM A193 and be sized as 3/8-inch up to 2-inch conduit and shall be 1/2 inch all-thread rod over 2-inch conduit. Material as specified herein.

C. SUSPENDED RACEWAY SUPPORTS AND RACKS:

Suspended raceway supports shall consist of concrete inserts, steel rod hangers, and jamb nuts supporting framing channel or lay-in pipe hangers as required. Framing channel shall be a minimum of 12-gauge. Material as specified herein.

Hanger rods shall be 1/2-inch diameter all-thread rod and shall meet ASTM A193. Suspended raceway supports and racks shall be braced for seismic forces as specified in Section 16000.

D. MATERIALS:

Table B specifies the type of raceway supports required for each location and application.

Table B

Location	Framing Channel	Threaded Rod, Hardwar Fittings
Indoor, Architecturally finished A	Steel, HDG	Steel, HDG
Indoor, Electrical Room	Stainless Steel,	Stainless Steel,
Indoor, Process Areas	Stainless Steel	Stainless Steel
Corrosive Area (hypochlorite area)	PVC	PVC
Corrosive Area (polymer a	PVC	PVC
Indoor, Corrosive Area (general	Stainless Steel	Stainless Steel
Outdoor, Corrosive Area (gener	Stainless Steel	Stainless Steel
Outdoor Areas, Non-corrosive	Stainless Steel	Stainless Steel

HDG = Hot Dip Galvanized Finish
PVC = PVC COATED

2.04 CONCRETE ENCASED DUCT BANKS

Concrete used for duct banks shall be Class E with red color added and a minimum 28-day compressive strength of 2,000 psi as specified in the Cast-in-Place Concrete Section 03300.

2.05 UNDERGROUND MARKING TAPE

Underground detectable marking tape shall be for early warning protection of digging around direct buried cables, conduits, and concrete duct banks. Tape shall be OSHA approved.

Marking tape example: Low density polyethylene plastic, nominally 6 inches wide and 4 mil thickness with metallic lined tape with red polyethylene film on top and clear polyethylene film on the bottom. Tape shall be imprinted with a warning continuously along the length similar to: "CAUTION - STOP DIGGING - BURIED ELECTRIC LINE BELOW."

Tape Products: Brady "Identoline"; Services and Materials "Buried Underground Tape"; Somerset (Thomas & Betts) "Protect-A-Line"; or equal.

2.06 NAMEPLATES

Nameplates shall be provided for boxes in accordance with the requirements of Section 16000. Nameplate wording shall be as shown on the drawings. Provide the functional description of the device on the nameplate, where wording is not specified

2.07 FIRESTOPS

Firestops and seals shall be Flamemastic 77, Vimasco No. 1-A, or equal, and shall be applied in accordance with manufacturer's recommendations. Products which are affected by water are not acceptable. Firestops shall be provide for all cable tray duct openings on concrete walls, no exceptions.

2.08 RACEWAY IDENTIFICATION

Raceway number tags shall conform to the requirements of raceway markers, Section 16000.

2.09 ELECTRICAL SEALANT

Electrical sealant putty shall be non-hardening, non-oxidizing, non-corrosive, non-poisonous, and non-injurious to human skin with service temperature range of 30 to 200 degrees Fahrenheit. Product shall be used to seal against the entrance of water.

2.10 HAZARDOUS AREA AND CORROSIVE AREA CONDUIT SEALS

Sealing compound shall be non-hardening type for corrosive areas. Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy or aluminum alloy. Seal fittings shall be 40-percent fill type.

Sealing compound shall be hard type installed in UL listed for explosion-proof sealing fittings after the conductors are installed, tested, and accepted.

Provide PVC-coated seal fittings used for PVC-coated conduit with 40-mil factory coating. Seal fitting and sealing compound manufacture: Appleton, Crouse-Hinds, or equal.

2.11 PULLING LINE

Pulling line shall be polyethylene type, mildew and rot resistant with minimum of 200-pound tensile strength and minimum 1/4-inch diameter. Install in all “future” raceways. Manufacture: Greenlee, Ideal, or equal.

2.12 CONDUIT THREAD LUBRICANT

Thread lubricant shall be conductive with anti-seize and anti-corrosion properties, compatible with steel and aluminum conduit materials. Manufacture: T&B CP8 KOPR-Shield; Robroy Threadcompound; or equal.

PART 3 EXECUTION

3.01 GENERAL

Table C specifies the type of raceway required for each location and application by RACESPEC sheet. Unscheduled conduit shall be galvanized, rigid steel, RACESPEC type GRS.

Table C

Location	Application/Condition	RACESPEC
Indoor noncorrosive	Exposed	RAC
Indoor corrosive	Exposed	PGRS
Outdoor	Exposed (WWTP) Exposed (other)	PGRS PGRS
Concealed	Power circuits embedded in concrete structure c beneath slab-on-grade	PVC4
Concealed	Instrumentation, communications and data signa encased in concrete, duct bank	PVC4
Underground	Power circuits encased in concrete, duct bank	PVC4
Underground	Instrumentation, communications and data signa directly buried	PVC4
Nonhazardous	Final connection to equipment and light fixtures	LFS
Hazardous corrosive	Exposed	PGRS
Hazardous	Final connection to equipment	XPFS
Architecturally finished areas	Concealed in framed walls and ceiling spaces (lighting and receptacle circuits only)	EMT
Architecturally finished areas	Final connection to light fixtures	FLEX

3.02 CONDUIT

A. GENERAL:

The conduit systems, installation, and hazardous location fittings are specified herein.

B. INDOOR AND OUTDOOR CONDUIT SYSTEMS:

In general, Contractor shall be responsible for determining conduit routing that conforms to the specified installation requirements:

1. Conduits for lighting and outlets: exposed
2. Conduits for process equipment: concealed or exposed
3. Conduit inside structures: concealed or exposed
4. Conduit concealed inside water chambers slabs and walls

Conduit installation shall conform to the requirements of the RACESPEC sheets and the following specified installation requirements:

1. Exposed conduit: Install parallel or perpendicular to structural members and surfaces. Install conduit horizontally and allow minimum headroom of 7 feet.

2. Route two or more exposed conduits in the same general routing parallel with symmetrical bends.

3. Space exposed conduit installed on supports not more than 10 feet apart. Space multiple conduits in parallel and use framing channel.

4. Comply with the requirements of Section 16000 and herein, where conduits are suspended from the ceiling.

5. Secure conduit rack supports to concrete walls and ceilings with cast-in-place anchors or framing channel concrete inserts.

6. Install conduits at least 6 inches from high temperature piping, ducts, and flues with temperatures higher than 90 degree C.

7. Install conduits between the reinforcing steel in walls or slabs that have reinforcing in both faces.

8. Place conduits under the reinforcement in slabs with only a single layer of reinforcing steel. Separation between conduits, conduits and reinforcement, and conduits and surfaces of concrete shall be maintained in accordance with UBC.

9. Route conduit clear of structural openings and indicated future openings.

10. Provide conduits with flashed and watertight seals routed through roofs or metal walls.

11. Grout conduits into openings cut into concrete and masonry structures.

12. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as “future”, “spare”, or “empty” and include a pulling line accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.

13. Determine concealed conduit stubup locations from the manufacturer's shop drawings. Terminate concealed conduit for future use in specified equipment.

14. Install conduit flush with structural surfaces with galvanized couplings and plugs. Caps and plugs shall match the conduit system.

15. Provide concealed portions of conduits for future equipment where the drawings indicate future equipment. Match the existing installation for duplicate equipment.

16. Terminate conduits that enter enclosures with fittings that match the NEMA rating of the enclosure.

17. Underground metallic or nonmetallic conduit that turn out of concrete, masonry or earth: Install a 90-degree elbow of PVC-coated rigid steel conduit before emergence above ground.

18. Provide O-Z Gedney "Type DX" or Crouse-Hinds "Type XD" bonded, weathertight expansion and deflection fitting for the conduit size where conduit across structural joints that allows structural movement.

C. UNDERGROUND CONDUIT SYSTEM:

Excavation, backfilling, and concrete work shall conform to respective sections of these specifications. Underground conduit shall conform to the following requirements:

1. Underground conduits shall be reinforced concrete encased that are not shown otherwise on the drawings.

2. Concrete encased conduit shall have minimum concrete thicknesses of 2 inches between conduits, 1 inch between conduit and reinforcing, and 3 inches between reinforcing and earth, unless shown otherwise in an electrical detail.

3. Concrete encasement on exposed outdoor conduit risers shall continue to 3 inches above grade, with top crowned and edges chamfered.

4. Underground conduit bend radius shall be not less than 2 feet minimum at vertical risers and shall be not less than 3 feet elsewhere.

5. Where conduit and concrete encasement are terminated underground, the conduit and reinforcing shall both extend at least 2 feet past the concrete. Conduits shall be capped and threads protected. Steel surfaces shall be given two coats of epoxy paint.

6. Underground conduits and conduit banks shall have 2 feet minimum earth cover unless otherwise shown.

7. Underground conduit banks through building walls shall be cast-in-place or installed with concrete into boxouts with waterstops on all sides of the boxout. Water-stops shall be as specified in the Cast-in-Place Concrete section. Extend the horizontal reinforcement from the duct bank into the boxout terminating with J-hook bends.

8. Conduits not encased in concrete and passing through walls with one side in contact with earth shall be sealed watertight with special rubber gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.

9. Thoroughly swab conduits and raceways on the inside, immediately upon completion of pouring concrete.

10. Label raceways in accordance with Section 16000.

11. After the concrete has set and before backfilling, pull a mandrel through each conduit. The mandrel shall have a diameter equal to the nominal conduit inside diameter minus 1/2 inch and shall not be less than 4 inches long.

12. If the mandrel showed signs of protrusions on the inside of the conduit, the conduit shall be repaired or replaced.

13. Provide manufactured plastic conduit spacers anchored to prevent movement during the concrete pour. Manufacture: Carlon, PW Pipe, Underground Devices, or equal.

14. Form the concrete pour ten feet from the wall, manhole, or handhole and form to allow for future conduit entry.

15. Backfill duct banks with clean fill compacted to 90-percent in 6-inch lifts after concrete has cured. Refer to Section 03300 for concrete requirements including minimum 7 days of cure time prior to backfill over duct banks.

16. Allow and provide for two offsets per conduit and raceway for each 100- linear feet to account for unexpected field conditions including for excavation and backfill limited to three feet of extra width and/or depth. Include these specified provisions in the bid price.

17. Provide PVC threaded adapter with female threads where PVC conduit is joined to steel conduit. Procedure:

    a. Before assembly: Double coat steel conduit with Red-Robroy, Green-Permacote, Blue-Ocal or equal product.

    b. After assembly: Seal with 65-mil thick, 2-inch wide mastic sealing tape to ½-inch beyond threads. Procucts: 3M Scotch 2228; Plymouth 02625; or equal.

    c. Cover with 20-mil corrosion protection tape applied in ½-lap layers to 2-inch beyond threads. Products: 3M Scotchwrap 51; Plymouth Plywrap 12; or equal.

18. Where reinforced concrete duct banks enter the side of a building, manhole, or handhole and the reinforcement cannot be brought into a window and be terminated, then drill the structure and embed the reinforcement in epoxy to minimum of 3-inches depth.

19. Provide PVC conduit with bell ends where duct banks terminated at walls, manholes, or handholes. Install bell ends flush with finished concrete.

20. Provide PVC conduit with bell ends where conduit rise below grade into a floor mounted electrical panel, electrical cabinet, MCC, switchboard, or switchgear.

21. Separate power conduits from signal conduit within the same ductbank by 12" or greater separation, as shown. Refer to the drawings or schedules for signal to be installed in metal conduits instead of PVC ducts.

22. Separate high voltage ductbanks from low voltage ductbanks, as shown.

23. Provide wireways for transition from underslab conduits rising into wall-mounted panels where the number of conduits exceed the NEC allowable panel space in the bottom of the panel. Provide conduit sleeves or fitting for panel transition. Continuous thread or all-thread is prohibited.

24. The Contractor shall provide detailed layout drawings or sketches for the underground conduit raceway systems. Make take-offs of the circuits and underground raceways required between electrical power and control equipment, process equipment, instrumentation, area lighting, receptacles, heat tracing, and eye-wash stations to assure all circuit are included prior to system construction.

    Drawings shall show plan view routing, pullboxes and manholes, consideration of other underground systems and structures, approximate system cover depths and widths, and section views showing sizes of conduits and circuits. Submit the underground conduit raceway systems drawings or sketches.

D. CONDUIT IN BLOCK WALLS

Install multiple runs of conduit that stub-up into a block wall and connect to recessed electrical panels with adequate space for the conduit. Coordinated the electrical work with the structural work and block installers to provide a chase to install the conduit. Install conduit in the cells that do not contain structural reinforcement. Install conduits in the center of the cell to avoid affecting the structural integrity of the wall.

Avoid conduit and electrical boxes installation that blocks the cell from being grouted or that blocks the cell reinforcing bars from being grouted. Avoid conduit in the first cell adjacent to doors, windows, corners and wall intersections and install conduits in the center of the first available cell a minimum of 1'-0" from the edge of these openings.

Where solid grouting of masonry walls is specified, install conduit and electrical boxes so as to provide sufficient space for grout to flow pass the boxes and conduit in order to fully fill the space beneath and behind. Where boxes need to be held in place, secure the boxes from the face of the block wall. Do not place items behind or next to electrical boxes to hold in place.

Coordinate split-face, slump and scored block installation with the masonry contractor to supply smooth face block at the location of receptacles and switches so that the device covers install flush to the wall. Install translucent weather-proof sealing material under device covers on outdoor or wet area locations.

E. CONDUIT SEAL-OFF FITTINGS:

Conduits passing:

1. Between Class I, Division 1 area and Class I, Division 2 area; provide sealing fittings located at the boundary in accordance with NEC Article-500.

2. From hazardous or corrosive area into a non-hazardous or non-corrosive area.

Install the seal-off material in the conduit seal-off fittings after inspection.

F. CONDUIT AND INNERDUCT SEALING MATERIAL:

Provide HYDRA-SEAL® Handi-Polyurethane-Foam or equal product to seal conduits and innerducts.

Sealing product required features:

1. Compatible with common cable jacket materials.
2. ASTM E-84 flame spread requirements and UL Classified.
3. Pre-pressurized, portable, one-component closed-cell foam sealing system.
4. Dries tack-free within 15 minutes and cures within 24 hours.
5. Reacts with applied moisture or with ambient humidity.
6. Remove over-spray with acetone and remove cured foam mechanically

Application Criteria:

1. Apply in ambient temperatures between 60° to 100° F.
2. Apply bead onto clean surface.

3.03 MANHOLES AND HANDHOLES

Unless otherwise specified, manhole and handhole installation shall be as follows:

1. Manholes, handholes, and pull boxes shall be set on a minimum of 6 inches of crushed rock on top of undisturbed or compacted earth.

2. Manholes and handholes shall be set plumb so that water shall drain to the sump.

3. Manhole covers shall be 36-inches in diameter and set at 2 inches above finish grade with surrounding pavement sloping away from the manhole cover.

4. Metallic hardware inside manholes and handholes shall be bonded to the ground plate or ground bus using bolted connections, bonding jumpers and grounding bushings.

3.04 CABLE TRAY

Unless otherwise specified or shown, cable tray installation shall be as follows:

1. Cable trays shall be supported at intervals not to exceed 5 feet.

2. Corners shall be supported by two supports installed as close as possible to the corner, with one support on each side of the corner.

3. Field cuts on steel cable tray shall be treated with zinc rich paint.

4. Expansion joint splice plates shall be used to allow 1 1/2 inch free movement between adjacent trays when crossing building expansion joint.

5. Cable tray shall have minimum clearance of 3/4 inch from concrete surfaces and minimum spacing of 14 inches from other trays. The top of the tray shall be minimum 14 inches from the ceiling.

6. Signal cable trays shall be provided with solid type covers.

7. Provide each cable tray with No. 2/0 AWG or No. 4/0 AWG minimum bare copper equipment ground conductor attached to the outside of each tray section using UL Listed bolted bronze or brass ground clamp and bond to the ground grid system.

8. Power cables shall be placed in cable trays in accordance with the NEC.

9. Cables shall be arranged in trays for minimum cross-over for entry or exit.

10. Provide cable tray barrier between power and control cables, if not in separate cable trays.

11. Provide cable tray barrier between control and instrument cable in the same cable tray.

3.05 RACEWAY NUMBERING

Each new and reused conduit shall be provided with a number tag at each end and in each manhole, handhole, or pull box. Cable trays shall be identified by stencils at intervals not exceeding 50 feet, at intersections, and at each end to identify power cable tray voltage, control cable tray, or instrument cable tray.

3.06 RACEWAY SCHEDULE

A. GENERAL:

Not used

B. UNSCHEDULED RACEWAY:

With the exception of lighting, communication, paging, fire alarm, security and receptacle circuits, the type and size of raceway shall be as specified on the drawings or schedules.

Unscheduled lighting and receptacle raceways shall be sized by the Contractor in accordance with the NEC. Minimum size shall be 3/4 inch for exposed and 1 inch for embedded raceway.

The number and size of communication, paging, fire alarm, and security raceways shall be as required for the particular equipment provided subject to the minimum sizes specified herein.

C. SCHEDULED RACEWAY:

The size and type of raceway shall be as specified on the one line and/or riser drawings .

3.07 RACESPEC SHEETS

The following RACESPECS are included in this section:

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	EMT
Description:	Electrical Metallic Tubing
Compliance:	ANSI and UL
Finish:	Electro-galvanized steel
Minimum size:	3/4 inch
Fittings:	Compression type. Fittings inside concrete block (CMU) walls: Concrete-tight.
Boxes:	Electro-galvanized sheet steel. NEMA Class 1 stamped or form-bent steel with screw covers.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	FLEX
Description:	Flexible Steel Conduit
Application:	Final connection to equipment subject to vibration or adjustment.
Compliance:	UL 1
Construction:	Spirally wound galvanized steel strip with successive convolutions securely interlocked.
Minimum size:	1/2 inch
Fittings:	Compression type
Other:	FLEX shall be provided with an internal ground wire.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	GRS
Description:	Galvanized Rigid Steel Conduit (GRS)
Compliance:	ANSI and UL
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Manufacturers:	Allied Tube and Conduit Corp., Wheatland Tube Co., or equal.
Minimum size:	Unless otherwise specified, 3/4 inch for exposed, 1 inch for embedded, encased, or otherwise inaccessible.
Fittings:	
Locknuts, Rings, Hubs:	Hot-dip galvanized insulated throat with bonding locknut or ring,. The hubs shall utilize a neoprene "O" ring and provide a watertight connection. O-Z Gedney, CHM-XXT, or equal
Unions:	Electro-galvanized ferrous alloy type Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or equal. Threadless fittings are not acceptable.
Conduit Bodies:	Oversized conduit bodies: Ferrous alloy type with screw taps for fastening covers to match the conduit system. Gaskets shall be made of neoprene.
Boxes:	
Indoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.
Outdoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	GRS (continued)
Corrosive:	NEMA 4X stainless steel or nonmetallic, as specified.
Hazardous:	NEMA Class 7 cast ferrous.
Elbows:	
(3/4" thru 1-1/2")	Factory fabricated or field bent.
(2" thru 6")	Factory fabricated only.
Conduit Bodies (Oversized):	
(3/4" thru 4")	Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for conduit entrances.
(5" and 6")	Electro-galvanized iron or cast iron box.
Expansion Fittings:	Expansion fittings in embedded runs shall be watertight with an internal bonding jumper. The expansion material shall be neoprene allowing for 3/4-inch movement in any direction.
Manufacturers:	Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or equal.
Installation:	Rigid steel conduit shall be made up tight and with conductive thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot-dip galvanized malleable iron straps with nesting backs or framing channel. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	RAC
Description:	Rigid Aluminum Conduit
Materials:	Conduit and fittings: 6063 aluminum alloy with temper designation T-1.
Compliance:	ANSI and UL
Finish:	Smooth finished outside and inside surfaces.
Manufacturers:	Alcoa, Allied Tube and Conduit Corp., Wheatland Tube Co., or equal.
Application /Conditions:	Indoors, corrosive and non-corrosive areas Outdoors, non-corrosive and non-process areas. Rigid aluminum conduit shall not be installed in concrete, direct buried, or where exposed to severe corrosion, or where exposed to physical damage.
Minimum size:	Unless otherwise specified, 3/4 inch for exposed, 1 inch for inaccessible.
Fittings:	Locknuts: stainless steel. Bushings: non-corrosive cast aluminum alloy, stainless steel, or nonmetallic. Bushings: insulating collar. Grounding bushings: locking type with a feed-through compression lug for securing the ground cables. Threadless fittings: not acceptable.
Manufacturers:	Thomas & Betts, O.Z. Gedney, Crouse-Hinds or equal.
Expansion Fittings:	Expansion fittings shall be watertight with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4-inch movement in any direction.
Manufacturers:	Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or equal.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	RAC (continued)
Hubs:	Hubs: threaded non-corrosive cast aluminum alloy with powdered epoxy finish for connection of conduit to junction, device, or terminal boxes. Hubs: insulating bushings with bonding locknut. Hubs: neoprene "O" ring for a watertight connection.
Manufacturers:	O-Z Gedney, CHM-XXT, or equal
Unions:	Unions shall be non-ferrous alloy type.
Manufacturers:	Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or equal.
Boxes:	
Indoor:	Type FD cast aluminum with powdered epoxy finish for device boxes and junction boxes with a dimension less than 6 inches for the longest side. NEMA Class 12 welded aluminum with threaded hubs with a dimension of 6 inches for the longest side and larger. Boxes in wet locations: PVC coated.
Outdoor:	Type FD, PVC coated, cast aluminum for device boxes and junction boxes with a dimension of less than 6 inches for the longest side. NEMA Class 4X welded stainless steel with threaded hubs for a dimension of 6 inches for the longest side and larger.
Corrosive:	NEMA 4X, stainless steel or PVC coated cast aluminum.
Hazardous:	NEMA Class 7 cast aluminum.
Elbows:	
(3/4" thru 1-1/2")	Factory fabricated or field bent.
(2" thru 6")	Factory fabricated only.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	RAC (continued)
Conduit Bodies:	
(3/4" thru 4")	Oversized conduit bodies: non-ferrous, copper-free aluminum alloy type with powdered epoxy finish and screw taps for fastening covers. Gaskets shall be made of neoprene. Tapered threads for conduit entrances.
(5" and 6")	Cast aluminum box.
Manufacturers:	Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or equal.
Installation:	Joints: made with standard couplings or threaded unions. RAC:

1. Made up tight with thread compound by Ideal, NoAlox anti-oxidant, Crouse-Hinds STL or equal.
2. Supported away from the structures and concrete using stainless steel straps with nesting backs.
3. Terminate with a threaded hub with a grounding bushing where entering boxes.
4. Exposed male threads on rigid aluminum conduit shall be coated with Teflon-rich product.
5. Threaded with manufacture approved special dies and bent proper tools.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PRAC
Description:	Rigid Aluminum Conduit, Corrosion-Resistant, Polyvinyl Chloride (PVC) Coated
Compliance:	ANSI and UL
Finish:	Smooth finished outside and inside surfaces. The rigid aluminum conduit shall have a minimum 40-mil thick PVC coating bonded to the outside of the conduit. A 2-mil coat of urethane coating shall be bonded to the inside. Coating shall be free of pinholes. Bond strength shall exceed the tensile strength of the PVC coat. Elbows shall be factory made and coated.
Manufacturers:	PVC coated rigid aluminum conduit shall be by Robroy Industries, OCAL Inc., or equal.
Application/Condition:	All locations outdoors, corrosive and process areas. Conduit transitions from concrete or ductbank shall be PRAC.
Minimum size:	Unless otherwise specified, 3/4 inch for exposed, 1 inch for inaccessible.
Fittings:	Similarly coated to the same thickness as the conduit and provided with type 316 stainless steel hardware. Conduit and fittings shall be manufactured by the same company.
Hubs:	Hubs for connection of conduit to junction, device, or terminal boxes shall be threaded and made of cast aluminum alloy. Hubs: PVC coating and insulated grounding bushings with a neoprene "O" ring for a watertight connection.
Boxes:	
Nonhazardous:	NEMA Class 4X stainless steel or PVC coated cast aluminum.
Hazardous:	PVC coated NEMA Class 7 cast alloy.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification: PRAC (continued)

Installation:

PRAC shall be made up tight, threaded, and installed using tools approved by the conduit manufacturer. All conduit threads shall be covered by a plastic overlap which shall be coated and sealed per manufacturer's recommendations.

Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating.

PRAC shall be supported away from the structure and concrete using PVC coated conduit wall hangers or PVC coated conduit mounting hardware.

Installers of PVC coated conduit shall be certified by the conduit manufacturer that they have received instruction on how to install PVC coated products.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	LFS
Description:	Liquidtight Flexible Steel Conduit
Application:	Final connection to equipment subject to vibration or adjustment.
Compliance:	UL 360
Construction:	Spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover.
Minimum size:	3/4 inch
Fittings:	Cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral. O-ring seals around the conduit and box connection and insulated throat. Provide forty-five and ninety degree fittings where applicable. Provide PVC coated flexible conduit and fittings where the conduit system is PVC coated.
Installation:	Length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit and not exceed 36 inches in length. Use conductive thread compound.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PGRS
Description:	Rigid Steel Conduit, Corrosion-Resistant, Polyvinyl Chloride (PVC) Coated. Provide factory made and coated elbows.
Compliance:	ANSI, ETL and UL. The PVC coated rigid galvanized steel conduit shall be stamped with the ETL Verification Mark “ETL Verified to PVC-001”.
Finish:	PGRS shall be hot-dip galvanized rigid steel conduit as specified in 16110-3.03 GRS, with a PVC Coating. The PVC coating shall be gray, minimum 40 mils thick, bonded to the outside and continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes. Thread protectors shall be used on the exposed threads of the PVC coated conduit. A 2-mil coat of urethane enamel coating shall be bonded to the inside. Coating shall be free of pinholes. Bond strength shall exceed the tensile strength of the PVC coat.
Minimum size:	3/4 inch
Fittings:	Similarly coated to the same thickness as the conduit and provided with Type 316 stainless steel hardware. Conduit and fittings shall be manufactured by the same company Conduit and fittings shall be coated by the same company. Male threads on elbows and nipples, and female threads on fittings or conduit couplings shall be protected by application of urethane coating.
Covers:	PVC coated covers shall have V-groove seal and stainless steel hardware.
Hubs:	Hubs for connection of conduit to junction, device, or terminal boxes shall be threaded cast ferrous alloy. Hubs shall have the same PVC coating as the conduit and insulating grounding bushings. Hubs shall utilize a neoprene "O" ring and shall provide a watertight connection.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PGRS (continued)
Boxes:	
Nonhazardous:	NEMA Class 4X stainless steel or nonmetallic.
Hazardous:	NEMA Class 7 cast ferrous.
Manufacturers:	PVC coated conduit that bears the ETL Verified PVC-001 label by Robroy Industries, Plasti-Bond, Perma-Cote, KorKap or equal.
Installation:	Plastic coated conduit shall be made up tight, threaded, and installed using tools approved by the PVC-coated conduit manufacturer. Exposed conduit threads shall be covered by a plastic overlap coated and sealed per manufacturer's recommendations. Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable. PVC coated conduit shall be supported away from the structure using PVC coated conduit wall hangers or PVC coated conduit mounting hardware. Damaged work shall be replaced
Training:	Installers shall be trained and certified in the proper installation techniques provided by the PVC-coated conduit system manufacture. Proof of certification shall be provided under paragraph 16110-1.03.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PCD-1
Description:	Power and Communications Duct.
Application:	Light wall thickness for concrete encasement, individually or in duct banks, as shown on the drawings.
Compliance:	ASTM F512/EB-20, NEMA TC-6
Construction:	Rigid nonmetallic utility duct, made of polyvinylchloride (PVC)
Minimum size:	1 inch
Fittings:	PVC solvent weld type

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PCD-2
Description:	Power and Communications Duct.
Application:	Medium wall thickness for direct bury in earth without concrete encasement.
Compliance:	ASTM F512/DB-60, NEMA TC-2
Construction:	Rigid nonmetallic utility duct of polyvinylchloride (PVC)
Minimum size:	1 inch
Fittings:	PVC solvent weld type

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PVC4
Description:	Rigid Nonmetallic Conduit.
Application:	Heavy wall thickness for direct bury, concrete encasement or surface mounting where not subject to physical damage.
Compliance:	NEMA TC2, UL 651
Construction:	Schedule 40, high-impact, polyvinylchloride (PVC)
Minimum size:	3/4 inch exposed; 1 inch embedded or encased
Fittings:	PVC solvent weld type
Boxes:	
Indoor:	NEMA Class 4, nonmetallic
Outdoor and corrosive:	NEMA Class 4X, nonmetallic
Installation:	PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O ring. Joints shall be made with standard PVC couplings. PVC conduit shall have bell ends where terminated at walls and boxes.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	PVC8
Description:	Rigid Nonmetallic Conduit
Application:	Extra heavy wall thickness for locations including direct bury under roadways where not exposed to traffic damage and surface mounted in corrosive areas.
Compliance:	NEMA TC2, UL 651
Construction:	Schedule 80, high-impact, polyvinylchloride (PVC)
Minimum size:	3/4 inch exposed; 1 inch embedded or encased
Fittings:	PVC solvent weld type
Boxes:	
Indoor:	NEMA Class 4X, nonmetallic
Outdoor and corrosive:	NEMA Class 4X, nonmetallic
Installation:	Exposed PVC conduit shall be run on supports spaced:

a. 3 feet apart for conduits up to 1 inch.

b. 5 feet apart for conduits 1-1/4 inches to 2 inches.

c. 6 feet apart for conduits 2 1/2 inches and larger.

d. PVC conduit not provided where damaged by heat.

e. Bell ends where terminated at walls, boxes and electrical cabinets and control panels.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	WW
Description:	Wireway and Auxiliary Gutter: Match the conduit or raceway system specified and shown on the drawings. Minimum: Flanged, oiltight type with hinged covers
Application:	As shown on the drawings.
Compliance:	JIC EMP-1
Sizes as shown:	4 inch by 4 inch, 6 inch by 6 inch, 8 inch by 8 inch
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Indoor non-corrosive area:	NEMA-1, NEMA-12, NEMA-4 or as shown on the drawings.
Outdoor and corrosive area:	NEMA-3R, NEMA-4X or as shown on the drawings.

3.07 RACEWAY SPECIFICATION SHEETS (RACESPEC)

Raceway Identification:	XPFS
Description:	Explosion-proof Flexible Steel Conduit
Application:	XPFS Conduit coupling shall be used for final connections to motors and other equipment subject to vibration or adjustment in Class I Division 1 hazardous areas and shall be watertight.
Size:	1/2 inch – 4-inch
Length:	4-inch – 36-inch

END OF SECTION

SECTION 16120 600 VOLT CONDUCTORS, WIRE, AND CABLE

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies stranded copper cables, conductors, and wire rated 600 volts insulation used for power; lighting, analog, digital, or pulse signals and control circuits.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to document shall mean the documents in effect at the time of Advertisement for bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire
NEMA WC7	Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy
NFPA 70	National Electric Code (NEC)
UL 44	Rubber-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300.

1. Submittals specified in Section 16000.
2. Complete catalog cuts for all conductors, wire, and cable.

PART 2 PRODUCTS

2.01 GENERAL

A. UNSCHEDULED CONDUCTORS AND CABLES:

Where not specified on the Drawings, conductors and cables shall be sized in accordance with the National Electrical Code for the particular equipment served with the minimum size as specified herein.

Unscheduled conductor with insulation shall be provided in accordance with the following:

1. CABLESPEC "MEPR/CPE" multi-conductor power and control cable

2. CABLESPEC “RHW” for single conductors

3. CABLESPEC “XHHW or THWN” for indoor power, lighting and receptacles

B. CABLE SPECIFICATION SHEETS (CABLESPEC):

General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets in paragraph 16120-3.06.

2.02 COLOR CODING

A. CONTROL CONDUCTORS:

Single-conductor control conductors shall have the following colors for the indicated voltage:

Control Conductor	120V
Power (AC)	Black
Control (AC)	Red
Neutral	White
Ground	Green
Foreign Voltage (DC)	Blue/White
Foreign Voltage (AC)	Yellow
Power (DC)	Blue
Control (DC)	Violet

B. POWER CONDUCTORS:

Power conductors shall have the following colors for the indicated voltage:

Power Conductor	480V	208/120V
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Ground	Green	Green
Neutral	Gray	White

Cables may be black with colored 3/4-inch vinyl plastic tape applied at each cable termination. Tape shall be wrapped with 25 percent overlay to provide 3 inches minimum coverage.

C. SIGNAL CONDUCTORS:

Signal cable conductors shall be color coded black and white for pairs or black, white, and red for triads. Each conductor and each group of conductors shall be numbered.

2.03 POWER AND CONTROL CONDUCTORS AND CABLE, 600 VOLT

A. SINGLE CONDUCTOR:

Provide stranded conductors for all cable or wires. Provide minimum conductor size of 12 AWG for power and lighting circuits and minimum conductor size of 14 AWG for control circuits.

B. MULTICONDUCTOR CABLE:

Provide multiconductor power cable and multiconductor control cable where identified on the drawings. Provide stranded conductors for all cable or wires.

2.04 SIGNAL CABLES

A. GENERAL:

Factory cable between manufactured instrument system components shall be provided in compliance with the instrument manufacturer's recommendations. Provide multi-conductor cables when required.

Signal cable shall be provided for instrument signal transmission. Single instrument cable (SIC) and multiple-circuit instrument cable (MIC) shall be provided in accordance with the following examples:

CABLESPEC “SIC”:
Cable designation: 1PR#16S shielded twisted pair (STP)
Cable designation: 1TR#16S triad (STT)

CABLESPEC “MIC":
Cable designation example: 4PR#16S with individual shields for each of the four pair and an overall shield and jacket for the multiconductor instrument cable.

B. COMMUNICATION, PAGING, AND SECURITY SYSTEM CABLES:

Voice communication, paging, and security system cables shall be specified in their respective specification sections.

2.05 PORTABLE CORD

Portable cord shall be provided in accordance with CABLESPEC "CORD," unless otherwise specified. Cords shall contain an equipment grounding conductor.

2.06 SPLICING AND TERMINATING MATERIALS

Connectors shall be tool applied compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Wire nuts for a splice is prohibited.

Signal and control conductors shall be connected to terminal blocks and field devices and instruments shall be terminated with conductor terminals as specified in paragraph 16000-2.02.

Connectors for wire sizes No. 8 AWG and larger shall be compression tool installed one-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable. In-line splices and taps shall be used only by written consent of the Construction Manager.

Power conductor splices shall be compression type, made with a compression tool die approved for the purpose, as made by Thomas and Betts Corp., or equal. Splices shall be covered with electrical products designed for the application, insulated, and covered with a heat-shrinkable sleeve or boot, as specified elsewhere.

Motor connection kits shall consist of heat-shrinkable, polymeric insulating material over the connection area and high dielectric strength mastic to seal the ends against ingress of moisture and contamination. Motor connections may use the Tyco Electronics removable boot product line.

Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations. Connection kits shall be independent of cable manufacturer's tolerances. Refer to the electric motor specification Section 11060.

2.07 CORD GRIPS

Cord grips shall be provided where indicated on the Drawings to attach flexible cord to equipment enclosures. Cord grips shall consist of a threaded aluminum body and compression nut with a neoprene bushing and stainless steel wire mesh for strain relief. Cord grip shall provide a watertight seal at enclosure interface and sized to accommodate the flexible cord.

PART 3 EXECUTION

3.01 GENERAL

Conductors shall be identified at each connection terminal and at splice points. The identification marking system shall comply with Section 16000.

Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the insulation or jacket. Manufacture recommended and UL Listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable.

Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed. Where wire or cable exits a raceway, a wire or cable support shall be provided.

Provide tin-plated bus bar. Scratch-brush the contact areas and tin plate the connection where flat bus bar connections are made with un-plated bar. Bolts shall be torqued to the bus manufacturer's recommendations.

Provide VFD rated cables as required by the Drawings with 2000V rated insulation and with 3 symmetric grounding cables. Manufacturer: Amercable/Nexans or equal,

3.02 600 VOLT CONDUCTOR AND CABLE

Conductors in panels and electrical equipment shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Cable ties shall be tensioned and cut off by using a tool specifically designed for the purpose such as a Panduit GS2B. Other methods of cutting cable ties are unacceptable.

Conductors crossing hinges shall be bundled into groups not exceeding 10 to 15 conductors and protected using nylon spiral flexible covers to protect conductors. Provide oversized plastic panel wiring duct within panels and panelboards.

Slack shall be provided in junction and pull boxes, handholes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls. Amount of slack shall be equal to largest dimension of the enclosure. Provide dedicated electrical wireways and insulated cable holders mounted on unistrut in manholes and handholes.

Raceway fill limitations shall be as defined by NEC and the following:

1. Lighting and receptacle circuits may be in the same conduit in accordance with de-rating requirements of the NEC. Lighting and receptacle circuits shall not be in conduits with power or control conductors. Signal conductors shall be in separate conduits from power conductors. Motor feeder circuits shall be in separate conduits including small fan circuit unless combination fan-light fixture.
2. Power conductors derived from uninterruptible power supply systems shall not be installed in raceways with conductors of other systems. Install in separate raceways.
3. Slices and terminations are subject to inspection by the Construction Manager prior to and after insulating.
4. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors.

5. In-line splices and tees, where approved by the Construction Manager, shall be made with tubular compression connectors and insulated as specified for motor terminations. Splices and tees in underground handholes or pull boxes shall be insulated using Scotch-cast epoxy resin or Raychem splicing kits.

6. Terminations at solenoid valves, 120 volt motors, and other devices furnished with pigtail leads shall be made using self-insulating tubular compression connectors within the termination box.
7. Terminations at valve and gate motor actuators shall be made directly into the actuator where possible. Power termination shall be made in the actuator power disconnect. Control and signal cable may be routed to a termination box near the actuator on 20-ampere rated terminal strips with label identification for the control and signal conductors. Single wire control conductors and analog cable (SIC or MIC) then installed in flexible conduit to the actuator control and signal termination compartments.

3.03 SIGNAL CABLE

Provide terminal blocks at instrument cable junctions within dedicated terminal boxes provided by the installer. Signal circuits shall be run without splices between instruments, terminal boxes, or panels.

Circuits shall not be made using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required.

Shields are not acceptable as a signal path, except for circuits operating at radio frequencies utilizing coaxial cables. Common ground return conductors for two or more circuits are not acceptable.

Shields shall be bonded to the signal ground bus at the control panel only and isolated from ground at the field instrument or analyzer and at other locations. Shields or drain wires for spare circuits shall not be grounded at either end of the cable run. Terminals shall be provided for running signal leads and shield drain wires through junction boxes.

Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes.

Where instrument cable splicing is required, provide an instrument stand with terminal box rated for the area and environment and mounted approximately 3 feet above grade for instrument cable splices with the circuits and individual conductors provided with label as specified in Section 16000.

Cable for paging, security, voice communication, and telephone systems shall be installed and terminated in compliance with the manufacturers and the Utilities recommendations.

3.04 PORTABLE CORD

Portable power cords feeding permanent equipment, such as pendant cords feeding motors for pumps, cranes, hoists, and portable items shall have a wire mesh cord grip of flexible stainless steel wire to relieve the tension from the cable termination. Connection of portable cords to permanent wiring shall be accomplished with dedicated boxes and terminals blocks.

3.05 TESTING

The Contractor shall test conductors, wire, and cable in accordance with Section 16030.

3.06 CABLE SPECIFICATION SHEETS (CABLESPEC)

A. GENERAL:

Conductor, wire, and cable types for different locations, service conditions and raceway systems are specified on individual cable specification sheets. Scheduled and unscheduled conductors, wires, and cables shall be installed in accordance with the CABLESPEC SHEETS.

B. CABLESPEC SHEETS:

The following CABLESPEC sheets are included in this section:

Type	Volt	Product	Purpose
MIC	600	SP-OS: MULTIPLE PAIR PR#18 or 16SH WITH OVERALL SHIELD AND JACKET	CABLE TRAY RATED INSTRUMENT CABLE
SIC	600	P-OS: 1-PR#18 or 16SH or 1-TR#18 or 16SH	CABLE TRAY RATED INSTRUMENT CABLE
RHW	600	RUBBER INSULATED OUTDOOR INDUSTRIAL GRADE SINGLE CONDUCTOR	POWER & CONTROL
THWN	600	PVC INSULATED WITH NYLON JACKET BUILDING GRADE CONDUCTOR	LIGHTS & RECEPTACLES
XHHW	600	XLP INSULATED INDUSTRIAL GRADE CONDUCTOR	POWER, CONTROL, LIGHTING, & RECEPTACLES
MEPR / [XLP] [CPE]	600	MULTICONDUCTOR RUBBER INSULATED CABLE WITH JACKET EXAMPLES: POWER CABLE: 3/C #500 KCMIL WITH FACTORY GROUND CONDUCTOR WITHIN CABLE CONTROL CABLE: 19/C #14	CABLE TRAY RATED POWER & CONTROL
MXLPE /S/ PVC	1000	MULTICONDUCTOR SHIELDED MOTOR CABLE WITH PVC JACKET	FLEXIBLE 3/C CABLE WITH NEC GROUND CONDUCTOR. MOTOR FEEDER RANGE: 16 AWG - 500KCMIL
COAX		RADIO FREQUENCY CO-AXIAL CABLE	DATA COMMUNICATIONS
SPC	600	EXTRA HEAVY DUTY FLAT PUMP CABLE WITH EP -INSULATION AND	DEEP WELL SUBMERSIBLE PUMP CABLE

Type	Volt	Product	Purpose
		CPE-JACKET	

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	MIC
Description:	Multiple twisted, shielded pairs, 18 or 16 AWG, with overall shield instrumentation cable; Number of pairs as shown; UL listed, Cable Tray rated.
Voltage:	600 volts
Conductor Material:	Bare annealed copper; Class-B stranded per ASTM B-8
Insulation:	15 mil, Polyvinyl Chloride (PVC) with 4 mil nylon, 90 degree C temperature rated Color Code per ICEA Method-1: Pairs- Black and White with one conductor in each pair printed alpha-numerically for identification
Lay:	Twisted on a 2-inch lay
Shield:	100 percent, 1.35 mil aluminum/polyester or mylar tape with 7-strand tinned copper drain wire
Overall Shield:	2.35 mil aluminum-Mylar tape with 7-strand tinned copper drain wire
Jacket:	Flame-retardant, moisture and sunlight resistant 45 mil Polyvinyl Chloride (PVC)
Flame Resistance:	UL 1277 and UL 1581 vertical tray flame test
Manufacturer(s):	Okonite, Okoseal-N type SP-OS (Shielded Pairs with Overall Shield); or Cooper Industries-Belden equal; or General Cable equal
Execution:	
Installation:	Install in accordance with paragraph 16120-3.03.
Testing:	Test in accordance with paragraph 16120-3.05.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	SIC
Description:	Single twisted, shielded pair or triad, 18 or 16 AWG, instrumentation and signal cable; UL listed; Cable Tray rated
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8
Insulation:	15 mil, Polyvinyl Chloride (PVC) with 4 mil nylon, 90 degree C temperature rated Color Code per ICEA Method-1: Pairs- Black and White with one conductor in each pair printed alpha-numerically for identification
Lay:	Twisted on a 2-inch lay
Shield:	100 percent, 1.35 mil aluminum-Mylar tape with a 7-strand tinned copper drain wire
Jacket:	45 mil Polyvinyl Chloride (PVC)
Flame Resistance:	UL 1277
Manufacturer(s):	Okonite, Okoseal-N Type P-OS (Pair(s) Overall Shield) and Type TOS (Triad(s) Overall Shield); or Cooper Industries-Belden equal; or General Cable equal
Execution:	
Use:	Analog signal cable and RTD device Triad extension cable.
Installation:	Install in accordance with paragraph 16120-3.03.
Testing:	Test in accordance with paragraph 16120-3.05.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	RHW
Description:	Single conductor power and control cable; Single Conductor 1/0 AWG - Cable Tray rated. Sizes: 14 AWG through 1000 kcmil as shown
Voltage:	600 volts
Conductor Material:	Bare annealed copper; Class-B stranded per ASTM B8
Insulation:	RHW-2 75 degree C wet; RHH 90 degree C dry; Composite of ethylene propylene rubber (EPR) per ICEA, UL 44 and NEMA WC-7.
Jacket:	Chlorosulfonated polyethylene; Trade Name Example: Hypalon
Flame Resistance:	IEEE 383 & 1202: 70,000 BTU per hour
Manufacturer(s):	Okonite: Okonite-Okolon, series 112-11-XXXX; Cablec: Durasheath EP; or Rome equal; or BICC equal.
Execution:	
Installation:	Install in accordance with paragraph 16120-3.02.
Testing:	Test in accordance with paragraph 16120-3.05.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	THWN
Description:	Single conductor lighting and receptacle type; Indoor branch circuit conductor.
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8
Insulation:	THWN/THHN, 90 degree C dry, 75 degree C wet, Polyvinyl Chloride (PVC) per UL 83.
Jacket:	Nylon
Flame Resistance:	UL 83
Manufacturer(s):	Okonite, Okoseal-N, series 116-67-XXXX; or equal.
Uses Permitted:	Lighting, receptacle and appliance circuits
Execution:	
Installation:	Install in accordance with paragraph 16120-3.02.
Testing:	Test in accordance with paragraph 16000-3.02 and Section 16030.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	XHHW
Description:	Industrial grade single conductor Sizes: 14 AWG through 750 kcmil as shown
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8
Insulation:	NEC Type XHHW-2; 90 degree C dry and C wet; Cross-Linked Polyethylene (XLP) per ICEA S-66-524 and UL-44; Color in sizes 14, 12 and 10 AWG: Black, Green, Yellow, White, Orange, Brown, Red, Blue
Jacket:	None
Flame Resistance:	UL 83
Manufacturer(s):	Okonite, X-Olene; Cablec, Durasheath XLP; or equal.
Uses Permitted:	Power, control, lighting and outlet circuits.
Execution:	
Installation:	Install in accordance with paragraph 16120-3.02.
Testing:	Test in accordance with paragraph 16000-3.02 and Section 16030.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	MEPR / CPE
Description:	Multiconductor Power Cable and Multiconductor Control Cable:14 AWG stranded conductors; Cable tray rated.
Power Cable:	Insulated green grounding conductor sized per the NEC.
Ground Conductor Size:	Multiple sets of multiconductor power cable: Oversize the grounding conductor per NEC 250.
Control Cable Type:	ICEA Method 1, E-2, without white neutral conductor or green ground conductor
Control Cable Identification:	Conductors color coded per ICEA and conductors numbered
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8, coated per ASTM B33
Insulation:	RHW/RHH, 90 degree C dry, 75 degree C wet, ethylene propylene rubber (EPR) per ICEA 2-68-516 and UL 44.
Jacket:	Cross-linked Polyethylene XLP Chlorinated Polyethylene CPE
Flame Resistance:	IEEE 383
Manufacturer(s):	Okonite, Okonite-Okolon-Okoseal series 202-11-3XXX; Cablec, Durasheath EP; or equal.
Execution:	
Installation:	Install in accordance with paragraph 16120-3.02.
Testing:	Test in accordance with paragraph 16000-3.02 and Section 16030.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	MXLPE / S / PVC
Description:	1000 Volt Rated - Flexible Motor Supply Shielded Cable
Power Cable:	Multi-conductor shielded motor feeder cable with PVC jacket: 3/C cable with conductors sizes from #16-AWG to #2-AWG with grounding conductor.
Ground Conductor Size:	Sized per NEC 250
Application:	Feeder cable between VFD motor controller and motor.
Conductor Material:	Flexible copper with high strand count
Insulation:	Thermoset Crosslinked Polyethylene (XLPE): 90 degree C dry, 75 degree C wet, per UL 44.
Jacket:	PVC over assembly; jacket thickness per UL 1277 Cable Tray rated UL 1277 Type TC
Shield:	Tinned copper braid and foil
Flame Resistance:	IEEE 383 Fire Test (70,000 BTU) IEEE 1202: Limited Smoke rated and labeled on cable jacket UL 1685: Vertical Tray Flame Exposure Test
Manufacturer(s):	Anixter B2095XX series Belden 295XX series LAPPUSA OLFLEX VFD Symmetrical: 1AWG - 500kcmil LAPPUSA OLFLEX Servo 2YSLCY-JB flexible cable

Execution:

Installation:	Install in accordance with paragraph 16120-3.02. Install in conduit or cable tray. Not to be used for open wiring installation. Ground shields at both ends. Shield terminating gland may be used at the motor to ensure grounding the shield.
Testing:	Test in accordance with paragraph 16120-3.05 and Section 16030.

Cable System Identification:	COAX
Description:	Premise Cable: Indoor Riser and Plenum with FRPE Jacket Outdoor / Watertight: Ductbanks Systems with PE Jacket Low Loss Flexible Communication Coaxial Cable

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	COAX
Voltage:	300 V; Voltage Withstand: 3000 Volts DC;
Conductor Material:	Solid 18 AWG; Nominal Impedance: 50-ohm; Nominal Capacitance: 20 Pico-Farad per foot; Bend Radius: 2 inches
Insulation Material:	Foam Polyethylene (PE) or Tetrafluoroethylene (TFE) UL Flame Test: NFPA-262 NEC Type Specification: CMP
Jacket:	Polyethylene (PE), Fire Retardant Polyethylene (FRPE) or Fluorinated Ethylene Propylene (FEP)
Manufacturer(s):	Times Microwave System: LMR-500; Belden Number 83242: 50-ohm Coax -- RG Type 142 B/U; or Engineer accepted equal.
Execution:	
Applications:	Giga-Hertz Data Communications, CCTV Fixed. Component or Composite Video, Digital Video
Installation:	Install in accordance with associated equipment manufacturer's instruction. Provide male, female, TNC Male, UHF Male, straight, bulkhead, right-angle etc connectors, fittings, with crimp tools, dies, strip tools, deburr tools and cutting tools as required for the installation.
Testing:	Test in accordance with paragraph 16120-3.05.

Cable System Identification:	SPC (EP/CPE)
Description:	Extra Heavy Duty Flat Submersible Pump Cable
Voltage:	600 Vac
Conductor Material:	Soft annealed copper per ASTM B-33 and ASTMB-172 configured as flexible rope-lay-stranded.

3.06 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	SPC (EP/CPE)
Insulation Material:	EP: ethylene propylene rubber: Class 2.5A 90-degree C UL62
Jacket:	CPE: Chlorinated Polyethylene Rubber per ICEA S-75-381 and S-68-516 rated as moisture resistant and flame retardant, 90-degree C Dry and Wet.
Color Code:	Phase Conductors: black, yellow, red Ground Conductor: green with yellow stripe
Sizes:	AWG #4 through 500 kcmil
Manufacturer(s):	Paige Pumpwire or Engineer accepted equal.

Execution:

Applications:	Deep water well submersible pump cable installed within well casings
Installation:	Install in accordance with associated equipment manufacturer's instruction.
Testing:	Test in accordance with paragraph 16120-3.05.

END OF SECTION

SECTION 16175 MISCELLANEOUS ELECTRICAL DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

The vendor, manufacturer, and custom control panels shall provide enclosures, selector switches, pushbuttons, indicators, terminal strips, surge devices, nameplates, testing procedures, wiring method, wiring color coding, wire labeling, separation between power, controls, and instruments, hardwired logic relays or PLC logic products as specified herein and in Section17000.

A. This section specifies electrical control and monitoring devices:

1. Control Devices:
   a. Pushbuttons
   b. Selector Switches
   c. Indicating Lights
   d. Control Station Enclosures

2. Control Relays:
   a. Load-Switching
   b. Logic Level Switching
   c. Timers and Time Switch
   d. Alternators

B. This section specifies power devices:

1. Magnetic Contactors:
   a. Lighting Contactors
   b. Motor Contactors

2. Safety Disconnect Switches
3. Field Instrument and Field Analyzer: Key-Switch in control station with surge devices
4. Overcurrent Protection: Circuit breakers
5. Elapsed Time Indicators
6. Current transformers and transducers
7. Time Switch
8. Motor Driven Timers – On Delay and Off Delay
9. Intrusion Switches and Override Key Switches
10. Thermostats
11. Static Ground Indicator and Interlock System

C. Request clarification where conflicts occur with this section and other sections in Divisions 11, 15, 16 and 17.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced

directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid or on the effective date of the Agreement if there were no Bids.

If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA ICS-1	General Standards For Industrial Controls and Systems
NEMA ICS-2	Industrial Control Devices, Controllers, and Assemblies
NEMA KS 1	Enclosed Switches

1.03 SUBMITTALS

The following submittals shall be provided in accordance with Section 01300 and Section 16176:

1. A copy of this 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, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

   Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
2. Arrangement drawings of the panel enclosure indicating the front door and panel equipment arrangement and dimensions, and enclosure type.
3. Nameplate legend with engraving and sizes.
4. Internal layout drawings showing all components.
5. List of materials and components with the layout drawings.

6. Elementary / schematic diagrams
7. Internal wiring connection diagrams.
8. External wiring interconnection diagrams including interlocks.
9. Power and control single line diagrams, where motor controllers are included.
10. Manufacturer's catalog data for all material provided under this section shall be assembled in a folder with each page clearly marked with the item model number and reference number to the specification.

PART 2 PRODUCTS

2.01 CONTROL DEVICES

A. PUSHBUTTONS:

Pushbuttons shall be flush head, heavy-duty, with NEMA rating to match enclosure type. Operators shall be green for start function, red for stop functions, and black for all other functions. The escutcheon legend shall be as specified on the drawings.

1. UL Listed.
2. Dielectric Strength: 1300 Volts for one minute for Logic Reed contacts, 2200 Volts for one minute for other contacts.
3. 30.5mm mounting hole.
4. Temperature operating range -10 degree C. to +55 degree C.
5. Momentary contact type
6. When switching circuits are monitored by programmable controllers or other solid state circuits, furnish hermetically-sealed, logic-reed type contacts rated not less than 0.15 amperes at 150 Vac and 0.06 amperes at 30 Vdc.
7. When switching circuits are not monitored by programmable controllers or other solid state circuits, furnish contacts with NEMA Utilization Category rating A600 rated not less than 10 amperes continuous and 6 amperes break at 120 Vac.

Manufacturer: Allen-Bradley 800T/800H series or equal.

B. SELECTOR SWITCHES:

Selector switches shall be heavy-duty with NEMA rating to match enclosure type. Selector switches shall have maintained position contacts. Switches shall be provided with contact blocks and number of positions as required performing the specified or indicated operations.

The escutcheon legend shall be as specified on the drawings. Provide:

1. UL Listed.
2. Dielectric Strength: 1300 Volts for one minute for Logic Reed contacts, 2200 Volts for one minute for other contacts.
3. 30.5mm mounting hole.
4. Temperature operating range -10 degree C. to +55 degree C.
5. Standard knob operator (not lever type nor wing lever type)
6. Number of positions and contact configuration as shown on Drawings.
7. When switching circuits are monitored by programmable controllers or other solid state circuits, furnish hermetically-sealed, logic-reed type contacts rated not less than 0.15 amperes at 150 Vac and 0.06 amperes at 30 Vdc.

8. When switching circuits are not monitored by programmable controllers or other solid state circuits, furnish contacts with NEMA Utilization Category rating A600 rated not less than 10 amperes continuous and 6 amperes break at 120 Vac.

Manufacturer: Allen-Bradley 800T/800H series or equal.

Field instruments and field analyzers specified in Section 17200 – Instrument Index shall have a lock-out style selector switch for locking on or locking off the 120Vac power source. The selector switch shall use a control station in NEMA-12, 4, 4X, or 7 as required by the area classification. Provide O-Z/Gedney Class 441 with two position key-operated maintained contact switch. Provide surge protection device that matches the enclosure type of the power disconnect type control station, field instrument, or field analyzer: Telematic TP48 transmitter surge protection device or equal.

C. INDICATING LIGHTS:

Red, amber, green, and blue indicating lights shall be heavy-duty full voltage 120Vac or 24Vdc push-to-test LED type with NEMA rating to match enclosure type for installation in a 30.5mm hole. Furnish with 28 chip high visibility LED. The escutcheon and lens color shall be as shown on Drawings or scheduled.

White indicating lights shall be as above, incandescent type lamp.

Manufacturer:

1. Allen-Bradley 800H-QRTH10 series or equal for 120Vac applications with colors other than white.
2. Allen-Bradley 800HQRTH24 series or equal for 24Vdc applications with colors other than white.
3. Allen-Bradley 800H-QRT10 series or equal for 120Vac applications with white.
4. Allen-Bradley 800H-QRT24 series or equal for 24Vdc applications with white.

Indicating Light Lens Color:

Lens Color	Typical Function	Example
Red Green	Danger, running	Equipment operating, motor running, valve open, power voltage applied, cycle in automatic
Amber	Fault condition, attention	Equipment failure, status abnormal
Green Red	Ready condition	End of cycle; unit or head returned; motors stopped; motion stopped; contactors open, valve closed
White or Clear	Normal condition	Normal pressure of air, water, lubrication, control power on, status okay
Blue	Advisory	Control mode not in automatic

D. CONTROL STATION ENCLOSURES:

1. Enclosures locations and ratings:

    a. Indoors: NEMA 12
    b. Outdoors and Corrosive areas: NEMA 4X stainless steel, or non-metallic in chlorine storage areas
    c. NEC 500 Hazardous Areas: NEMA-7.

E. CONTROL POWER TRANSFORMERS:

1. Sized for the panel devices and products.
2. Dual primary and single secondary fusing.

2.02 CONTROL RELAYS

A. LOAD-SWITCHING CONTROL RELAYS:

Control relays used for switching loads such as solenoids, actuators, contactors, motor starter coils, remote interlocking, etc. shall be heavy-duty machine tool type.

Contacts shall be 4-pole and be field interchangeable to either normally-open or normally-closed. Relay shall be capable of accepting a 4-pole adder.

AC relays shall have NEMA A600 contact ratings and electrical clearances for 600 volts. DC relays shall have NEMA P300 contact ratings and electrical clearances for 250 volts.

Manufacturer: Allen Bradley Bulletin-700, Square D Class 8501, or equal.

B. LOGIC LEVEL SWITCHING CONTROL RELAYS:

Control relays for signal circuits shall have a minimum of three SPDT, gold-flashed, fine silver contacts rated 3-ampere resistive at 120V AC or 28Vdc.

Control relays shall be plug-in type with heavy-duty, barrier-protected screw terminal sockets and clear polycarbonate dust cover with clip fastener.

AC models shall have neon lamp indicator wired in parallel with coil. DC models shall have LED lamp indicator wired in parallel with coil.

Manufacturer: Potter Blumfield series KUP; Schrack Series RA; or equal

C. TIMERS:

1. Multi-function, micro-controller based, socket mounted timing relay.
2. Single functions:

    a. Delay on Make
    b. Delay on Break
    c. Recycle (on time first, equal recycle delays)
    d. Single shot
    e. Interval
    f. Trailing edge single shot
    g. Inverted single shot

h. Inverted delay on break
i. Accumulative delay on make
j. Re-triggerable single shot

3. Dual functions:

a. Delay on make/delay on break
b. Delay on make/recycle (on time first, equal recycle delays.)
c. Delay on make/interval
d. Delay on make/single shot
e. Interval/recycle (on time first, equal recycle delays)
f. Delay on break/recycle (on time first, equal recycle delays)
g. Single shot/recycle (on time first, equal recycle delays)
h. Recycle – both times adjustable (on time first)
i. Recycle – both times adjustable (off time first)
j. Interval/delay on make
k. Accumulative delay on make/interval

4. Time delay range, switch selectable:

a. Single function 0.1 second to 1,705 hours in 8 ranges.
b. Dual function 0.1 second to 3,100 minutes in 8 ranges.
c. Setting accuracy +/- 1 percent or 50 milliseconds, whichever is greater.
d. Repeat accuracy +/- 0.1 percent or 16 milliseconds, whichever is greater.

5. Output:

a. Two Form-C electromechanical isolated contacts rated 10-amperes resistive at 240Vac
b. Rated 1/3-horsepower at 120 or 240Vac
c. Double-pole double-throw: DPDT.
d. Mechanical life: 10,000,000 operations
e. Electrical life: 1,000,000 operations at full load.

6. Mounting: Magnal Plug 11-pin socket
7. Environment: -20 to +65 degree C.
8. Manufacture:

a. ABB / SSAC's multifunction type TRDU time delay relay with dip-switch function setting with 12Vdc, 24Vac, 120Vac, 240Vac inputs as required or indicated or equal.

D. TIME SWITCH

Provide an electronic time switch with full-year control in a NEMA 3R enclosure. The switch shall incorporate a non-volatile memory that maintains programmed switching times for the life of the time switch and provide a factory installed field replaceable lithium or alkaline battery for time keeping and calendar information for a minimum of 8 years. Furnish with one single-pole, double-throw output switch rated 20-ampere at 240Vac. Furnish with manual override control.

Manufacturer:

a. Intermatic Model ET70115CR or equal.
b. Paragon Electric Company, Inc. EC71ST or equal.

E. ALTERNATING RELAY

1. Alternate assignment between “Duty” and “Stand-by” at the end of each run cycle. Double-pole, double-throw output relay rated for 7-amps inductive at 120-volts AC. Isolation not less than 1,500-volt RMS input to output. Life of 1,000,000 operations at full electrical load.
2. Switch to select alteration or continuous operation of either load.
3. Mount in Magnal 11-pin socket.
4. Operating temperature range of -20 to +60-degree C.
5. Manufacturer: ABB-SSAC type ARP series or Engineer accepted substitute.

F. MOTOR DRIVEN TIMERS- ON DELAY AND OFF-DELAY

1. Time Delay Relay - Upon Energization (TDE) or Upon De-Energization (TDDE): TDE driven by a 120 Vac synchronous motor that starts timing when initiated by an external signal via closing a dry contact. Turn a knob on the front of the dial for time settings. TDE device will reset upon power failure. TDDE device will not reset upon power failure. Special configuration where specified: will not reset upon power failure.
2. Provide a pilot light visible from the front of the timer to indicate when the timer motor is energized. Provide visual indication by a cycle progress pointer that advances to zero from the setting then back to zero as time progresses.
3. Provide two of "instantaneous" NEMA Form-C output contacts that actuate when the timing is initiated. Provide two "delayed" NEMA Form-C contacts that actuate when the unit has timed out or de-energized. The timer automatically resets, when the timing cycle is completed. Contact ratings: 10-ampere at 120 Vac and 5-ampere at 240 Vac.
4. Permanently mount and setup the timer with the initial settings shown or specified. Timer range with 16 configurations from 5-seconds to 60-hours. Range and timer setpoints shown on drawings.
5. Timer Manufacturer: Eagle Cycl-Flex Automatic or Manual Reset Timer: HP5 series or HP5E series; Automatic Timing Controls, Series 305D Motor Driven Analog Reset; or equal.

2.03 MAGNETIC CONTACTORS

A. LIGHTING CONTACTOR:

Lighting contactors shall be 100 percent rated for ballast and tungsten lighting, resistance and other non-motor loads.

Contactor shall be rated 600Vac, 60-Hertz with the ampere rating and number of poles as indicated on the drawings. Provide a minimum of two poles per NEMA ICS 2-211B for industrial-duty applications.

The following options shall be available and shall be provided as indicated on the drawings:

1. Auxiliary contacts rated 5-amperes at 600Vac.
2. Timer or time clock attachment.
3. Transient suppression module for 120Vac control circuits.

4. Electrically or mechanically held as specified.

Contactors shall be provided with disconnecting means and overcurrent protection mounted in the same enclosure.

Manufacturers:
1. Allen Bradley Bulletin 500L or 500LP
2. Square D Class 8903
3. ASCO 918 Remote Control with control module
4. or equal.

B. MOTOR CONTACTORS:

Motor contactors shall be designed for continuous operation of induction motors at 600Vac or less at 60-Hertz and shall comply with NEMA ICS 2-210. Unless otherwise specified or indicated, minimum contactor size shall be NEMA Size-1.

Motor contactors shall be supplied with a normally open auxiliary contact for use as a hold-in-contact and status contacts with a minimum of two additional Form-C contacts. Provide 120Vac coil voltage and 60-Hertz frequency with the number of poles and auxiliary contacts as indicated.

Manufacturer: GE, ABB, Allen Bradley, Square D, Eaton-Cutler Hammer or equal.

Provide solid-state overloads relays with one alarm contact. Where specified and shown as E-SSOL, provide the electronic SSOL relay: Automatic Timing and Controls (ATC) Motor Guardian for alarming and tripping on under-current, over-current, single-phase, ground-fault, motor-jam conditions. Provide ATC current transformers and voltage connections.

Manufacturer: ATC Lancaster, PA. Model: Motor Performance Analyzer; or equal.

2.04 SAFETY DISCONNECT SWITCHES

Safety disconnect switches shall be heavy-duty, 30-400-ampere ratings as indicated, non-fused as indicated, stainless steel operator, safety type rated 600 volts AC.

Enclosure locations and ratings:

1. Indoor enclosures: NEMA 12
2. Outdoor or corrosive areas: NEMA 4X nonmetallic for chlorine storage areas, or stainless steel
3. Hazardous areas: NEMA 7
4. Classified areas: Suitable for the specified classification.

The operating handle shall be capable of being padlocked in the "off" position. The operator shall be a positive, quick-make, quick-break mechanism. Provide bolt-on hubs. Provide door lock. Provide nameplates with the equipment tag number, equipment description, and power source as indicated on the drawings. Submit nameplate list.

Switches shall be horsepower rated for motors and shall comply with NEMA KS-1. Switches shall be provided with defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position. Switches shall have line terminal shields.

Manufacturer: ABB, Cutler-Hammer, General Electric, Square-D, or equal.

2.05 OVERCURRENT PROTECTION

A. CIRCUIT BREAKERS:

Circuit breakers shall be thermal magnetic, molded case type with the ampere rating as specified. Unless otherwise specified or indicated, circuit breaker interrupting rating shall be 22,000 amperes symmetrical.

2.06 ELAPSED TIME INDICATORS

Elapsed time indicators shall be panel mounted, non-resettable, 5.5-digit, hour indicator, rated 120Vac, 60-Hertz.

2.07 CURRENT TRANSFORMERS AND TRANSDUCERS

Provide monitoring current transformers with 600Vac insulation and primary ampere rating as indicated with 5-ampere output.

Provide AC current transducer for any one of the phase conductors of the power circuit to be installed through onboard toroid. Provide a loop-powered transducer with input rated from 0 to 50-ampere with 4-20madc analog output scaled for the primary current of the current transformer. Provide zero and span adjustments.

Manufacturer: ABB AC current transducer TCSA Series Loop Powered and mounting accessories, or equal.

Provide a DIN rail or back plate mounted AC current transducer that is a loop-powered transducer with input rated from 0 to 5-ampere and with 4-20madc analog output scaled for the primary current of the current transformer.

Manufacturer: ABB AC current transducer DCSA Series Loop Powered and mounting accessories, or equal.

2.08 TERMINAL STRIPS, BLOCKS, AND DEVICES

A. Power Wiring: Provide back plate mounted terminal strips rated at 600 Vac.

B. Control Wiring: Provide a DIN rail with spring powered contact rated at 300 Vac 24 ampere with pluggable terminals.

C. Terminal identification standard to the product provided.

D. Manufacturer:

1. Standard: Allen Bradley or equal.
2. Standard: DIN rail: Phoenix Contact or Weidmuller Z-Series.

2.09 INTRUSION DEVICES – NOT REQUIRED

2.10 THERMOSTATS

Thermostats shall be line voltage type with motor current rated contact and 70-degree to 140-degree Fahrenheit setpoint range.

Manufacturer: Honeywell T631A-1022 or equal.

2.11 STATIC GROUND INDICATOR - NOT REQUIRED

2.12 NAMEPLATES

Nameplates for all control stations, relays, timers, motor contactors and disconnect switches shall be provided in accordance with the requirements of Section 16000-2.02G.

2.13 PRODUCT DATA

Operation and maintenance data as specified in Section 01730 including approved submittal manufacturer's catalog data, as-built drawings, and instructions for all configurable or programmable components.

PART 3 EXECUTION

Control stations, contactors and safety disconnect switches shall be mounted 48 inches above the floor, ground, or slab to center of device.

Miscellaneous electrical devices shall be tested in accordance with Section 16000 and Section 16030.

END OF SECTION

SECTION 16260 AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies automatic transfer switches (ATS) rated 600 volts and less for lighting, HVAC, and motor loads for the Manatee Lift Station Rehabilitation Project with rating as indicated on the drawings.

The ATS shall use electrically-operated, mechanically-held, power rated, electrical contactors to provide double throw switching action with number of poles as shown or specified.

1.02 AUTOMATIC TRANSFER SWITCH SCHEDULE

TAG NO.	LOCATION	ENCLOSURE	RATING
ATS-1011	ELECTRICAL BUILDING	INDOOR NEMA-12	1200A 3-POLE, 3-WIRE

1.03 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

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Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE Standard 446	Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
NEC Article 701 and 702	National Electrical Code: Legally Required or Optional Standby Systems
NFPA 70 - NEC	National Electric Code
NEMA ICS 6	Enclosures for Industrial Controls and Systems

Reference	Title
NEMA Standard ICS10	AC Automatic Transfer Switches
NFPA 110	Emergency and Standby Power Systems
UL 508	Industrial Control Equipment
UL 1008	Standard for Automatic Transfer Switches

1.04 QUALITY ASSURANCE

A. LISTING:

The ATS shall be Underwriters Laboratory listed in accordance with UL 1008.

B. SUBMITTALS:

The following submittals shall be provided in accordance with Section 01300:

1. A copy of this 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.

   A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

   Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Arrangement drawings of the transfer switch enclosure indicating the front door and rear panel equipment arrangement and dimensions.
3. List of materials and components shall accompany the arrangement drawing.
4. Elementary and internal connection diagrams.
5. Manufacturers' data marked to indicate momentary, interrupting, and continuous current ratings of all relevant equipment, components, and devices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section.

This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section.

Candidate manufacturers include Russelectric, ASCO, Eaton, GE-Zenith, or equal.

2.02 RATING

The voltage, current, frequency and number of poles shall be as specified and shown. The ATS shall be rated 480 Vac and rated to close onto and withstand a fault, with the Withstand Closing Rating (WCR) of 65,000 symmetrical amperes.

The ATS shall be labeled with ratings. Series rating components are not acceptable.

2.03 FACTORY TEST

The ATS shall be factory tested to ensure proper operation

2.04 CONTROL AND MONITORING

The switch shall contain the following devices in the control circuit:

1. Voltage pickup relay, adjustable 85 to 100 percent.
2. Frequency pickup relay, adjustable 90 to 100 percent.
3. Time delay relay for open transition from normal to emergency (TDNE): adjustable from 0.2 to 50 seconds, initially set at 0.2 seconds.
4. Time delay relay for open transition from emergency to normal (TDEN): adjustable from 0 to 30 minutes, initially set at 20 minutes.
5. Time delay for open-transition to allow motor load EMF decay: adjustable from 1 to 10 second, initially set at 7 seconds.
6. Engine cool-down timer: 0-60 minutes, initially set at 30 minutes.
7. ATS transfer test switch mounted on equipment cover or door.
8. Switch position indicating lights: green light for normal source and red light for emergency source.
9. Generator start command: output relay.
10. Engine Generator Exerciser: Adjustable exerciser with no-load or load transfer, start time, duration, retransfer, and cool-down time.
11. Monitoring: Event logging with data, time, and reason.
12. Output status and alarm contacts:
    a. Normal status (2-sets Form-C)
    b. Standby status (2-sets Form-C)
    c. Trouble alarm (2-sets Form-C)

2.05 TERMINATIONS

Arrange internal equipment items for power cable bottom entry and bottom exit.

Provide oversized termination lugs as required for the size and quantity of conductors. Provide copper bus, terminations, and connections.

2.06 ENCLOSURE

The enclosure shall be floor or supported from the floor mounted and shall be suitable for locations as indicated on the drawings and as described below:

1. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids.

The enclosure painted finish shall be ANSI-61 Gray or Manufactures Standard. Stainless steel enclosures shall not be painted.

2.07 NAMEPLATES

The switch shall be identified as indicated on the drawings and nameplates shall be provided in accordance with the requirements of Section 16000.

2.08 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Operation and maintenance information including product data specified in Section 01730.
2. Final reviewed submittal, record drawings, ATS factory and field configuration settings included in the O&M data.

2.09 OPTIONS

PART 3 EXECUTION

3.01 FIELD ADJUSTMENTS

The time delay relays shall be adjusted to the following values:

1.	Normal to emergency time delay:	5 minutes
2.	Emergency to normal time delay:	20 minutes
3.	Open Position time delay:	3 seconds
4.	Voltage pickup:	90 percent
5.	Frequency pickup:	95 percent

3.02 WIRING

The control and monitoring wiring shall be installed as shown.

3.03 FIELD TESTS

The following tests shall be performed on the equipment provided under this section. Tests shall be in accordance with the latest version of UL and NEMA standards.

1. Electrical insulation check to verify the integrity and continuity of the system

2. Visual inspection to ensure that the switch matches the specification requirements and to verify fit and finish meet quality standards

3. Mechanical tests to verify that the switch's power sections are free of mechanical hindrances
4. Test the ATS using engine-generator set per Section 16231.

The automatic transfer switch shall be acceptance field tested in accordance with Section 16030.

Legally Required Standby Systems shall conform to NFPA-70: NEC Article 701 requirements for installation, wiring, grounding, and signage.

Configure the ATS for scheduled operation in accordance with Owner. An exact schedule to be determine upon equipment commissioning phase. Contractor should schedule 2 weeks in advance of ATS commissioning to Engineer and Owner for scheduling.

END OF SECTION

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SECTION 16311 LOW VOLTAGE SWITCHBOARDS

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies indoor, front accessible, deadfront power distribution switchboards rated 600 volts, 3 phase, 60 Hertz.

Provide metal oxide varistor (MOV) surge protective device (SPD) integral within each panelboard that indicates the status and condition of the SPD, tested per NEMA LS-1, rated IEEE C3 Combined Wave of 20kV and 10kA with 200kAIC internal fusing and listed / labeled per UL 1449.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C57.13	Requirements for Instrument Transformers
IEEE	Institute of Electrical and Electronic Engineers
NEMA PB 2	National Electrical Manufacturer Association Deadfront Distribution Switchboards
UL 891	Underwriters Laboratory - Deadfront Switchboards

B. LISTED PRODUCTS:

Electrical equipment and materials shall be listed for the purpose per Section 16000.

C. FACTORY TESTS

Switchboards shall be tested for operation at the specified voltage and current ratings after assembly. The main circuits shall be given a dielectric test of 2200 volts for 1 minute

between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for 1 minute between live parts and ground.

Instrument transformers shall have ratio and phase angle tests made in conformance with ANSI C57.13.

1.03 SUBMITTALS

The following information shall be submitted in accordance with Section 01300:

1. A copy of this 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. A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. A copy of the contract document single line diagrams, building plan, and elevation drawings relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. *Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

3. Catalog data on all electrical devices and components mounted on or within the switchboard.

4. Manufacturer's data indicating interrupting, withstand, and continuous current ratings of all relevant equipment and components.

5. Arrangement and layout drawings of the switchboard enclosures indicating equipment and bus arrangement and dimensions including areas of permissible cable entries. A list of material and components shall accompany the layout drawings. Include weight and shipping split data.

6. Manufacturer's certification that equipment meets the seismic requirements.

1.04 PROJECT/SITE CONDITIONS

Ambient and seismic conditions shall be as specified in paragraph 16000-1.05.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Switchboards shall be provided in accordance with UL 891, NEMA PB 2, and as specified. Provide Arc Flash mitigation products that are offered in the manufacturer's literature.

The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Candidate manufacturers include:

A. Eaton "Pow-R-Line" with Magnum SB breakers

B. General Electric Co. "AV Line"

C. ABB

D Siemens

E. Schneider – Square D

F. or equal

2.02 CONSTRUCTION

A. ARRANGEMENT:

Switchboards shall be new, deadfront, indoor type, metal enclosed, self-supporting, and suitable for 600 volts, 3 phase, 3 or 4- wire service as indicated on the Drawings. Suitable for mounting against a wall without rear access.

Switchboards shall be provided with vertical sections bolted together to form rigid units with switching and protective devices of the number, rating, and type specified.

Interconnections, instrumentation, and control wiring shall be completed in the factory so that site work is limited to bolting shipping sections and connecting cable assemblies.

B. STRUCTURE:

Structural members shall be universal frame die formed type, bolted and braced using self-tapping bolts. Cover plates shall be steel having formed edges. Front plates shall be sectionalized and removable. Lifting eyes shall be provided and switchboards shall be capable of being rolled or moved into position and bolted directly to the floor without the use of floor sills. Switchboard enclosure rating shall be NEMA-1A.

C. FINISH:

The finish shall comply with Section 16000.

2.03 COMPONENTS

A. BUS BARS:

Buses shall be tin-plated copper of sufficient size to limit the temperature rise to 65 degrees C, based on UL 891.

Unless otherwise specified, buses shall be braced to withstand short circuit stresses up to 65,000 RMS amperes. Main horizontal bus shall be mounted on glass polyester insulators and shall have the continuous capacity specified.

A ground bus having a momentary rating at least equal to the highest momentary rating of any circuit breaker in the assembly shall extend the full length of the switchboard. Ends of the ground bus shall be provided with clamp-type terminals for No. 4/0 AWG bare copper grounding conductors.

B. CIRCUIT BREAKERS:

1. GENERAL: Circuit breakers shall be stored energy type mechanism to provide quick-make, quick-break, trip-free operation:

    a. Insulated case UL listed 100 percent continuous current capacity.
    b. Molded case UL listed 80 percent continuous current capacity.
    c. Ground fault protection shall be provided as specified or indicated.

Circuit breakers shall provide manual switching operation by means of a low-torque handle or pushbutton on the front of the unit. Automatic operation during overload and short circuit conditions shall be provided by solid state or thermal magnetic tripping devices located in the circuit breaker frame as specified on the drawings.

Circuit breakers shall be front accessible, stationary, individually mounted, and shall have short circuit capabilities equal to or greater than the system in which they are installed.

Circuit breakers shall have a minimum interrupting current of 65,000 amperes symmetrical RMS at 480 Vac.

2. STATIC TRIPPING DEVICES: Solid state static tripping devices shall consist of current sensors, logic assembly, magnetic latch release, and required interconnecting wiring. Tripping devices shall be automatic and self-contained within the breaker frame and shall not require any external relaying or power supplies.

Tripping functions shall be field adjustable and contain the following tripping characteristics:

a. Overload tripping:
    1) Adjustable ampere setting
    2) Adjustable long-time delay

b. Short circuit tripping:
   1) Adjustable short-time pickup
   2) Adjustable short-time delay
   3) Adjustable instantaneous pickup

c. Ground fault tripping:
   1) Adjustable ground fault pickup
   2) Adjustable ground fault delay

C. PANEL INSTRUMENTS AND ACCESSORIES:

Panel instruments and accessories shall be as specified on the drawings or schedules and provided in accordance with Section 16440 where the section is included in the Contract Documents or provide the manufacturer's standard metering with associated potential and current transformers with accessories. Switchboard shall be provided with microprocessor based power meter similar to GE Model PQM, or equal with harmonic analysis and event data logging.

D. NAMEPLATES:

In addition to the manufacturer's identification, switchboards shall be provided with phenolic nameplates indicating switchboard, main breaker, and feeder breaker designations as specified. Nameplates shall comply with Section 16000 and the NEC for uniquely labeling the power loads and using equipment Tag Numbers and Tag Descriptions where shown on the drawings or schedules.

E. CONDUCTOR MARKERS:

Conductor markers shall comply with Section 16000.

F. WIRING:

Internal switchboard wiring shall consist of single conductor SIS 90 degree C copper wire and UL listed for panel wiring. The wire shall be sized to suit load requirements. Minimum size shall be No. 14 AWG.

2.04 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Results of breaker setting tests as specified in paragraph 16311-3.02.
2. Operation and maintenance information as specified in Section 16000, including final reviewed submittal.

PART 3 EXECUTION

3.01 PROTECTIVE DEVICE SETTINGS

The protective relays and static tripping devices shall be adjusted to the settings specified in the protective device coordination study in Section 16431 prior to energizing the switchboard.

The instrument transformer ratios and protective devices shown on the drawings are preliminary and are subject to confirmation with the coordination study in Section 16431.

3.02 FIELD TEST

Each switchboard breaker shall be tested in accordance with Section 16030 – Testing.

END OF SECTION

SECTION 16431 ARC FLASH ANALYSIS, SHORT CIRCUIT STUDY, AND PROTECTIVE DEVICE COORDINATION REPORT

PART 1 GENERAL

1.01 DESCRIPTION

A. GENERAL:

This section specifies that the Contractor subcontract an independent full member NETA Engineering and Study Firm / Testing Firm to prepare:

1. Electrical equipment short circuit study (SCS) for all facility new and existing equipment (Existing electrical Equipment which remains in the pump station building after demolition).
2. Existing equipment includes:
   a. GEN 1011 – Generator
   b. Generator Circuit Breaker 1200 Amp
   c. Generator Docking Station
3. Protective device coordination study (PDCS) report for major new distribution equipment: SWBD-1000 Sect 1 and 2, MCC-1000, VFDs, Panel LP1 and transformer, GEN 1011.
4. Arc flash analysis (AFA) and labeling for all equipment.

The Testing Firm shall be Rozell without exception and shall also be responsible for the electrical testing described therein.

B. SCOPE:

The Short Circuit and Protective Device Coordination Report shall include analysis including Utility Company equipment that affect the installed equipment's short circuit ratings, protective device ratings and protective device settings.

Report shall also include analysis of the equipment's short circuit ratings, protective device ratings and protective device settings affected by the installed equipment.

Report shall include the results of the arc flash hazard analysis study for energized electrical equipment in accordance with the methods outlined in IEEE Standard 1584 and stated hereinafter.

Work shall include the fabrication of signs with the arc flash hazard study results and the installation of the signs on the equipment in accordance with NFPA 70E Table 3-3.9.3 that includes the personnel protective equipment (PPE) risk category, the energy available, and the clothing recommendation.

All studies shall be performed using SKM Power Tool Software, no equal.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the

listed documents, the requirements of this section shall prevail.

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Reference	Title
IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
NETA ATS	Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

1.03 SCHEDULE

The report shall be completed, submitted to the Construction Manager for acceptance and reworked to include the Construction Manager comments and corrections, as required. The report shall be approved by the Construction Manager prior to purchase and fabrication of electrical equipment including switchgear.

A copy of the Construction Manager accepted report shall be sent by the Contractor to all affected manufacturers prior to fabrication.

1.04 SUBMITTALS

The report specified in this Section shall be provided in accordance with Section 01300.

PART 2 PRODUCTS

2.01 REPORT

The product shall be a certified report summarizing the short circuit and coordination study and conclusions or recommendations which may affect the integrity of the electric power distribution system. As a minimum, the report shall include the following:

1. The equipment manufacturer's information used to prepare the study.
2. Power Utility Company system information applicable to the project.
3. Short circuit calculations listing short circuit levels at each bus. Provide a sketch of the bus and use both the project term and the bus-code-name to identify the bus, branches, sources, loads. Base the system on the Project One-Line diagram.

4. Coordination study time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.

5. Comparison of short circuit duties of each bus to the interrupting capacity of the equipment protecting that bus.
6. Data used as input to the report that includes cable impedances, source impedances, equipment ratings for the equipment being purchased for the project, etc.
7. Assumptions made during the study.

PART 3 EXECUTION

3.01 GENERAL

Provide a short circuit and coordination study on the electrical power distribution system as specified and as described in Section 6.1 of NETA ATS. The studies shall be performed in accordance with IEEE Standards 141 and 242 and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010.

The studies shall be performed using actual equipment data for both existing and new equipment. The coordination study shall use the data from the same manufacturer of protective relay devices as being provided by the switchgear manufacturer.

For new equipment, the Contractor shall provide copies of final reviewed equipment submittals upon request by the Study Firm.

For existing equipment, the Study Firm shall provide [one] separate one man-day trips of onsite investigation to identify loads and power distribution equipment data.

Any power distribution equipment outages shall be scheduled in advance and coordinated with the Owner to limit process outages as required per plant process capacities, refer to Sections 01015, 01040, and 16000.

3.02 QUALIFICATIONS

The short circuit and coordination report shall be performed by the Testing Firm as described in Section 16030. The studies shall be signed by the professional electrical engineer responsible for the studies and registered to practice engineering in the state in which the project is located.

3.03 SHORT CIRCUIT STUDY

The Contractor shall be responsible to obtain and verify all data needed to perform the study. As a minimum, the short circuit study shall include the following:

A. One-Line Diagram

1. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
2. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.

3. Power, voltage ratings, impedance, primary and secondary connections of all transformers.

4. Type, manufacturer, and ratio of all instrument transformers energizing each relay.
5. Nameplate ratings of all motors and generators with their subtransient reactances. Transient reactances of synchronous motors and generators and synchronous reactances of all generators.
6. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors.
7. Significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.
8. Emergency as well as normal switching conditions, as applicable.
9. The time-current setting of existing adjustable relays and direct-acting trips, as applicable.

B. Impedance Diagram

1. Available MVA, voltage, and impedance from the power utility company.
2. Local generated capacity impedance.
3. Bus impedance.
4. Transformer and/or reactor impedances.
5. Cable impedances.
6. Equipment impedances.
7. System voltages.
8. Grounding scheme for the project: resistance grounding, solid grounding, or no grounding.

C. Calculations

1. Determine the paths and situations where short circuit currents are the greatest.
2. Study shall address bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
3. Calculate the maximum and minimum fault currents.

3.04 ARC FLASH ANALYSIS

The Contractor shall be responsible to obtain and verify all data needed to perform the study.

The arc flash analysis study shall include the following IEEE Standard 1584 nine step analysis process:

1. Collect system and installation data.
2. Determine modes of operation.
3. Determine bolted fault current.
4. Determine arc fault current.
5. Determine protective device characteristic and arc fault duration.
6. Document system voltages and equipment class.
7. Select working distances.
8. Calculate incident energy.
9. Calculate the arc flash protection boundary.

3.05 PROTECTIVE DEVICE COORDINATION STUDY

As a minimum, the coordination study for the power distribution system shall include the

following on 5-cycle, log-log graph paper:

1. Time-current for each protective relay or fuse showing graphically that the settings will provide protection and selectivity within industry standards. Each curve shall be identified, and the tap and time dial settings shall be specified.
2. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the Construction Manager shall be notified as to the cause.
3. Time-current curves and points for cable and equipment damage.
4. Circuit interrupting device operating and interrupting times.
5. Indicate maximum fault values on the graph.
6. Sketch of bus and breaker arrangement.

3.06 IMPLEMENTING PDCS SETTINGS AND ARC FLASH SIGN INSTALLATION

The Testing Firm shall implement the protective device coordination study settings on new and existing equipment as required in Section 16030, based on the Engineers accepted Protective Device Coordination Report specified herein and submit a final amended report of the Record As-Built electrical equipment protective device settings subsequent to start-up and testing.

The Testing Firm shall work with the Contractor and the Study Firm for implementing the Arc Flash Hazard sign installation requirements for electrical equipment as specified in NEC Article 110.16 Flash Protection and NFPA 70E.

END OF SECTION

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SECTION 16440 INSTRUMENT TRANSFORMERS, METERS, SWITCHES AND ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies instrument transformers, meters, test switches and accessories for electrical distribution equipment assemblies.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C37.20	Switchgear Assemblies Including Metal-Enclosed Bus
ANSI C39.1	Requirements for Electrical Analog Indicating Instruments
ANSI C57.13	Requirements for Instrument Transformers

PART 2 PRODUCTS

2.01 INSTRUMENT TRANSFORMERS

A. GENERAL:

Instrument transformers shall be molded dry-type in accordance with ANSI C57.13. Transformer volt-ampere rating shall be suitable for carrying the specified load without overheating or exceeding the permissible accuracy for the transformer.

B. POTENTIAL TRANSFORMERS:

Potential transformers shall have an ANSI accuracy class of 0.3. They shall be equipped with current limiting fuses.

C. CURRENT TRANSFORMERS:

Current transformers shall be furnished with the specified ratios. The accuracies shall conform to ANSI C37.20.

2.02 PANEL METERS AND POWER MONITORS

All indicating meters shall be 4-1/2-inch square, semi-flush mounted switchboard type. The movement shall be taut-band with an accuracy of plus or minus 1 percent of full scale. The case shall be black. The scale shall be white with black markings. The length of the scale shall be greater than 7 inches over a deflection angle of 250 degrees. The meters shall be manufactured in accordance with applicable requirements of ANSI C39.1.

Power Monitors and Analyzers shall be the standard product of the electrical equipment manufacture with the standard electrical parameter selection and display.

Power Monitors are required on all new electrical equipment: switchgear, switchboard, motor control center, automatic transfer switch to provide electrical parameter information about the electrical equipment for any voltage class. Two power monitors are required for double-ended and dual feed electrical equipment.

Power Monitors, where shown on the drawings, shall have the following analog 4-20 mAdc outputs:

1. Phase-Phase Voltage
2. Average Current
3. Power Factor or VARs
4. Kilo-Watt Hours

Power Analyzer Monitor combination units, where shown on the drawings, shall have harmonic analyzer ability that displays the voltage / current harmonic and the Total Harmonic Distortion for the electrical equipment being monitored.

Where specified or indicated, provide manufacture standard power monitor with 4-analog outputs and RS-485 data communication output with modbus protocol.

2.03 INSTRUMENT SWITCHES

Instrument switches shall be provided with contact blocks and positions specified. Switches shall be of the rotary-cam type and contacts shall have positive wiping action of silver-to-silver contact buttons. Switches shall be provided with escutcheon plates and pistol-grip handles. Switches shall be General Electric, SBM; Siemens, ABB equal.

Voltmeter and ammeter switches shall have four positions with the escutcheon legend as follows:

Voltmeter	OFF	1-2	2-3	3-1
Ammeter	OFF	Phase A	Phase B	Phase C

2.04 KEY INTERLOCK

Where specified, the key interlock shall consist of two or more identically keyed brass bolt locks. The bolt on the lock shall prevent the operation of the electrical equipment. One brass key shall be provided for each group of identical locks. The key shall be held captive when the lock is positioned to allow equipment operation.

2.05 INDICATING LIGHTS

Indicating lights shall be resistor type of the voltage specified.

2.06 NAMEPLATES

Nameplates shall be provided in accordance with Section 16000.

2.07 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Operation and maintenance items as specified in Section 01730.
2. Manufacturer's product data with features and dimensions of devices.
3. Burden, accuracy class, and ratio data for instrument transformers.

PART 3 EXECUTION

Accessories and devices shall be installed per the electrical distribution equipment manufacturer's instructions.

END OF SECTION

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SECTION 16445 SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

Surge Protective Devices (SPD) replaces the Transient Voltage Surge Suppressors (TVSS) based on the National Electrical Code requirements.

A. SCOPE:

Provide SPD with electrical characteristics and ratings for service entrance equipment, switchgear, switchboards, motor control centers, and panelboards specified in the Division 16 electrical distribution equipment specification sections or indicated on the Drawings. Provide SPD with the same voltage, phase, 3 or 4 wire system as the host electrical equipment.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).

If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI / Underwriters Laboratories 1449 3nd Edition	Surge Protective Devices
Underwriters Laboratories 1283 3rd Edition	Electromagnetic interference filter for noise attenuation
MIL STD 220A, Rev A, Change Notice #2	Method of Insertion Loss Measurement
National Electrical Code 2008 Article 285	Surge-Protective Devices (SPDs), 1 kV or Less
NEMA LS-1	National Electrical Manufactures Association: Low Voltage Surge Protective Devices

Reference	Title
C-UL	Canadian Underwriters Laboratories
ANSI / IEEE C62.41	American National Standards Institute/Institute of Electrical and Electronic Engineering Inc.

1.03 RELATED SPECIFICATIONS

A. Division 16:

1. Section 16310 - Metal Enclosed Drawout Switchgear
2. Section 16311 - Switchboards
3. Section 16312 - Power Feeder Busway
4. Section 16470 - Panelboards
5. Section 16754 - Service Entrance Equipment
6. Section 16920 - Motor Control Centers

1.04 SUBMITTALS

A. The following information shall be submitted to the Engineer:

Submittals and transmittal procedures for submittals are defined in Section 01300. Submittals should be required for the following conditions:

1. A copy of this 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.
2. 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
3. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review."
5. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL).

6. Compliance: File number verified on UL's website or other NRTL's website, with the following information:
   a. Model number
   b. SPD Type
   c. System voltage, phases
   d. Protection modes
   e. Voltage Protection Rating (VPR)
   f. Nominal Discharge Current (In).
7. Drawings showing unit dimensions, weights, installation instruction details, and wiring configuration for sidemount SPD mounted external to electrical assembly.

1.05 PRODUCT DATA

A. The following information shall be submitted:

1. Final Record as-built drawings and information.

1.06 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. The manufacturer shall be ISO 9001 or ISO 9002 certified for the equipment specified herein.

C. The manufacturer shall have produced similar electrical equipment for a minimum period of five years.

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

B. One copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 PRODUCTS

2.01 MANUFACTURERS

The listing of manufacturers does not imply acceptance of products that do not meet the specified ratings, features, and functions. Manufacturers listed shall meet the specifications in their entirety.

Products in compliance with the specification and manufactured by others not named will be considered if pre-approved by the Engineer ten days prior to bid date.

A. ABB

B. Eaton

B. General Electric

C. Siemens

D. Square D

E. Accepted equal

2.02 SURGE PROTECTIVE DEVICES

A. ELECTRICAL REQUIREMENTS:

1. Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV): Not be less than 125% of the nominal system operating voltage.
3. SPD suppression system include thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and other distribution levels.
4. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may lead to system upset or create environmental hazards.
5. SPD shall protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (In): SPDs applied to the distribution system shall have a 20kA In rating that include Types 1 and 2 or operating voltage. SPD's with "In" that is less than 20kA, shall be rejected.

7. Voltage Protection Rating (VPR): The maximum VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SURGE PROTECTIVE DEVICE DESIGN:

1. SPD's containing replaceable modules, replaceable fuses, replaceable batteries, requiring maintenance, or requiring diagnostic test kit shall not be accepted.
2. BALANCED SUPPRESSION PLATFORM: The surge current shall be equally distributed to MOV components for equal stressing with equal impedance paths to each matched MOV.

3. ELECTRICAL NOISE FILTER: EMI/RFI noise rejection filter for noise attenuation of line noise of 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.
4. INTERNAL CONNECTIONS: Plug-in component modules or printed circuit boards shall not be used as surge current conductors. Components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. MONITORING DIAGNOSTICS: SPD monitoring:

    a. STATUS: Green / red solid-state indicator light for status of the protection on each phase.
        (1) For wye configured units, provide indicator lights for status of protection elements and circuitry in the L-N and L-G modes and in the N-G mode.
        (2) For delta configured units, provide indicator lights status of protection elements and circuitry in the L-G and L-L modes.
        (3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode.
        (4) Status indicators indicate the protection on each phase or mode. If power is removed from any one phase, the indicator lights shall indicate the status of the protection on other phases and protection modes.

    b. REMOTE ALARM: Provide Form C dry contacts (one NO and one NC) for remote annunciation. Both contacts change state under fault condition.

    c. AUDIBLE ALARM AND SILENCE BUTTON: Audible alarm activates upon fault conditions. Alarm silence button silences the audible alarm.

    d. SURGE COUNTER: LCD display indicates number of surges and trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton allows the surge counter to be zeroed and contains a mechanism to prevent accidental resetting of the counter.

6. Overcurrent Protection:
    a. The unit shall contain thermally protected MOVs shall disconnect the MOV(s) from the system during a thermal runaway condition.

7. DESIGN: SPD's components and diagnostics shall be contained within one discrete assembly.
8. Safety Requirements:
    a. SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts.
    b. SPD's designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit and required conductors be factory installed.
    c. Sidemount SPD's shall be factory sealed in order to prevent access to the inside of the unit with factory installed phase, neutral, ground and remote alarm contacts shall have conductors protruding outside of the enclosure for field wiring.

2.03 SYSTEM APPLICATION

A. SPD include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. The minimum surge current capacity:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations, Switchboards, Switchgear, MCC, Main Entrance	250 kA	125 kA
	High Exposure Roof Top Locations and Distribution Panelboards	160 kA	80 kA
A	Branch Locations: Panelboards, MCCs, Busway	120 kA	60 kA

C. SPD's installed on the line side of the service entrance disconnect: Type 1.

D. SPD's installed on the load side of the service entrance disconnect: Type 1 or 2.

2.04 PANELBOARDS

A. SPD application includes lighting and distribution panelboards, tested for application within ANSI/IEEE C62.41 Category B environments.

1. SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPD's installed following the load side of the main breaker and in main lug only panelboards installed following the incoming main lugs.
3. SPD interfaced to the panelboard via a direct bus bar connection. Or SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors integrally to the SPD and located directly adjacent to the 30A circuit breaker.
4. SPD shall be mounted within the panelboard by the manufacturer.
5. SPD shall be of the same manufacturer as the panelboard.
6. Panelboard including the SPD shall be UL67 listed.

B. SIDEMOUNT MOUNTING (SPD mounted external to electrical assembly):

1. Lead length between the breaker and suppressor shall be short as possible.

C. SWITCHGEAR, SWITCHBOARD, MCC AND BUSWAY REQUIREMENTS:

1. Service entrance located SPD's shall be tested within ANSI/IEEE C62.41 Category C environments.
2. SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway.
3. SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer.
4. Locate SPD on the load side of the main disconnect device, close to the phase conductors and the ground/neutral bar.

5. SPD connected through a disconnect (30A circuit breaker) located in immediate proximity to SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD shall be as short as possible per the factory specifications.
6. Monitoring and diagnostic features shall be visible on the front of equipment.

2.05 ENCLOSURES

A. Enclosed equipment shall have enclosures:

1. NEMA 1: Constructed of polymer for units integrated within electrical assemblies or steel for sidemount units for indoor use that provide protection against the ingress of solid foreign objects and falling dirt.
2. NEMA 4: Constructed of steel intended for either indoor or outdoor use to provide protection against access to hazardous parts; to provide protection from the ingress of rain, sleet, snow, splashing water, and hose directed water; and undamaged by the external formation of ice on the enclosure on sidemount units.
3. NEMA 4X: Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection on sidemount units.

PART 3 EXECUTION

3.01 GENERAL

Host equipment Manufacturer's representative shall visit the site, verify installation and testing, and verify that the SPD equipment and SPD installation meets intent of the Contract Documents and manufacturer's warranties and that the guarantees are in effect.

3.02 INSTALLATION

A. Install according to manufacturers recommendations.

B. Lead lengths shall not exceed manufactures recommendation.

C. Electrical equipment manufacturer shall authorize and perform bus taps connections, as necessary.

3.03 TRAINING

Provide a minimum of 1-hours of training for similar SPD systems and conforming to the requirements of Section 01664. Training shall be certified on Form 11000-B specified in Section 01999.

3.04 WARRANTY

The manufacturer shall provide a ten year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and applicable national or local code.

END OF SECTION

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SECTION 16446 LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. Contractor shall provide the lightning protection system design by a qualified Lightning Protection System (LPS) firm registered to design lightning protection systems.
2. Contractor shall provide design, furnish and install a complete lightning protection system for the following facilities and structures:
   a. New Electrical Building
   b. Existing Pump Building
   c. Existing Antenna
3. Contractor shall test and certify that the lightning protection system design, installation, and testing comply with the lightning protection industry standards as applied to the project facilities and structures.
4. Contractor shall provide the LPS firm with the plant or facilities drawings that indicate the equipment, buildings, structures, and HVAC equipment as the basis for their design work.
5. Contractor shall submit the design drawing to the Design Review Agency for approval and to the Engineer for reference.

B. Coordination:

1. Lightning Protection Systems design shall be arranged in accordance with the class of structure to be protected.
2. Coordinate arrangement and connections with roof system proposed for use and roof mounted equipment. Refer to the structural and architectural drawings provided by the Contractor.

C. Related Sections:

Contractor shall coordinate the requirements of the Work in this Section along with the requirements of the sections listed:

1. Section 16000 - Electrical
2. Section 16450 - Grounding Systems.

1.02 QUALITY ASSURANCE

A. Quality Control:

1. Lightning protection system materials shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems.
2. Materials shall comply in weight, size, and composition for the class of structure to be protected.

3. Lightning protection systems shall be installed under the direct supervision of a Lighting Protection System Certified Master Installer.

B. Certification Requirements:

1. Provide and submit Master Installer Certified forms for the following:

a. Form LP1-175A - Jobsite Witness of Grounding Connections.
b. Form LP1-175B - Post-Installation Inspection.
c. UL Master Label C.

C. References:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/IEEE C62.1	Surge Arresters for AC Power Circuits
ANSI/IEEE C62.11	Metal-Oxide Surge Arresters for Alternating Current Power Circuits
LP1-174	Lightning Protection Institute Installation Code
LP1-175	Lightning Protection Institute Standard of Practice
NEC	National Electric Code (NEC): Article 230 – Services Article 250 – Grounding Article 280 – Surge Arrestors Article 501 – Class I Locations Article 502 – Class II Locations Article 800 – Communications Circuits
NFPA-780	Lightning Protection Code
UL Standard No. 96	Lightning Protection Components

Reference	Title
UL Standard No. 96A	Master Label Provisions

1.03 SUBMITTALS

A. Shop Drawings:

The following submittals shall be provided in accordance with Section 01300

1. Manufacturers technical information for materials proposed for use.
2. Complete scaled drawings identifying the system arrangement and equipment connections for each building.
3. Drawings shall include equipment connection details, down-lead details, routing of system conductors, and locations of air terminals.

B. MASTER LABEL CERTIFICATES:

1. Submit certificates for LP1 Code Compliance together with UL Master Label C certificates.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials:

1. General: System materials shall be copper and high copper-content bronze castings.

   a. Fittings, except cable holders, shall be heavy-duty type made from bronze castings.
   b. Terminal rods, bolts, screws, and related type hardware shall be copper clad steel or brass to prevent galvanic corrosion.

2. Components: The system shall consist of the necessary equipment as required to provide a complete and coordinated system. Cable and air terminals used shall bear the UL Label. The components shall consist of, but not limited to, the following:

   a. Cables.
   b. Air terminals.
   c. Mounting bases.
   d. Fittings.
   e. Couplings.
   f. Connectors.
   g. Fasteners.
   h. Conduit.
   i. Pitch pads and weatherproof seals.

2.02 MANUFACTURERS

The Owner and Construction Manager believe the following candidate firms are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section.

The candidate detailed design, product manufacturer, and installation firm shall be one of the following or accepted equal:

A. Thompson Lightning Protection Inc.

B. AC Lightning Security.

Early Streamer Emission (ESE) is prohibited product system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify field measurements as indicated on the drawings and as specified elsewhere herein.

B. Conceal system conductors where practical and main down-leads and roof risers shall be concealed within the building walls or columns.

C. Allow six foot minimum clearances as required by the NEC from:
   1. Lightning rod conductors to non-current-carrying metal parts of electrical equipment unless they are bonded to the rods;
   2. Lightning conductors to open conductors of communications systems;
   3. Lightning protection grounding electrodes to electrodes of other grounding systems.

D. Do not use lightning protection rods and electrodes in place of the grounding electrodes for electrical equipment.

E. Run leads in 1-inch Schedule-80 PVC plastic conduit.

F. Terminate upper end above floor ceiling, utilize through-roof connectors for cable roof penetrations. Conduit terminations at lower end to be 6-inch above finished ground level, to pinpoint locations during future inspections.

G. Bond metallic objects and systems at roof level.

H. Primary bonds using appropriate fittings and full-size conductor:

   1. Roof intake and exhaust fans, HVAC units, ductwork, piping, ladders, skylights, stacks, vents, etc.

   2. Down-leads to steel column or major framing member at every down-lead position.

I. Secondary bond using secondary cable and fittings:

1. Metal bodies of inductance located within six feet of a conductor

2. Equipment with primary bond.

J. Connect to structure ground grid system using exothermic welds.

K. Ensure installation of air terminals to withstand wind force equivalent to 100 miles per hour with a gust factor of 1.3 without structural damage and without damage to the integrity of the lightning protection system.

L. Interconnect the Lightning Protection System to the building grounding grid at one location. Suggest the design indicate the interconnection be on opposite side of the building's service entrance location.

END OF SECTION

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SECTION 16450 GROUNDING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies the system for grounding electrical distribution and utilization equipment, including but not limited to cabinets, motor frames, manholes, instrumentation, metal surfaces of process/mechanical equipment that contain energized electrical components, metal structures and buildings, outdoor metal enclosures, fences and gates.

The Equipment Grounding Conductor shall ground or bond equipment, structures, or equipment frames to the Grounding Electrode System as defined in the National Electrical Code Article 250 and addressed herein.

The minimum size of the Equipment Grounding Conductors installed with the circuit conductors shall be per the National Electrical Code Table 250.122. The circuit grounding conductor size routed with a feeder or branch circuit conductors is as shown on the drawings.

1.02 REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE Std 81.2-1991	Guide to Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
NETA - ATS	InterNational Electrical Testing Association Inc. - Acceptance Testing Specifications
NFPA 70	National Electric Code (NEC) Article 250

1.03 SUBMITTALS:

The following information shall be submitted for review in accordance with Section 01300:

A. PRODUCT LITERATURE:

1. A copy of this 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. A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. Marked product literature for ground rods, test wells, and equipment ground plate.

PART 2 PRODUCTS

2.01 GROUND CONDUCTORS

The System Ground Conductor shall be soft-drawn, bare annealed copper, concentric stranded, as specified. The minimum sizes shall be as follows, where American Wire Gage (AWG) conductor sizes are not shown or specified:

5 and 15 kV switchgear	2/0 or 4/0 AWG
5 kV motor starters	2/0 or 4/0 AWG
15 kV-5 kV transformers	2/0 or 4/0 AWG
5 kV-480V transformers	2/0 or 4/0 AWG
480V switchgear	2/0 or 4/0 AWG
480V switchboards	2/0 or 4/0 AWG
480V MCC and	2/0 or 4/0 AWG
Cable tray	2/0 or 4/0 AWG
Large motors 250 hp & >	2/0 or 4/0 AWG
Lighting & Power panels	2 AWG
Exposed metal cabinets	2 AWG
Electrical equipment	2 AWG
Buildings and enclosure	2 AWG
Fences and gates	2 AWG
Motors 25 hp to 250 hp	2 AWG
Motors 1 hp to 25 hp	6 AWG

2.02 GROUND RODS

Ground rods shall be copper covered steel, 3/4-inch diameter and 10-feet long. Rods shall have threaded type removable caps so that extension rods of same diameter and length may be added where necessary.

2.03 COMPRESSION CONNECTORS

Not acceptable

2.04 BOLTED CONNECTORS

Not acceptable

2.05 WELDED CONNECTORS

Exothermic welding products shall be Erico's Cadweld Plus system with a remotely operated battery powered electronic ignition device and moisture resistant weld metal cup for the required mold, or equal.

2.06 TEST WELLS

Provide concrete test well with cover and connect the ground grid extension using a removable connector.

2.07 EQUIPMENT GROUND BARS

Copper equipment ground bars shall be Erico Eritech EGB Series or equal, sized as required for the installation.

2.08 EQUIPMENT GROUND PLATE

Equipment ground plate shall be two-hole copper flush mounted grounding plate, Erico Cadweld, Burndy YGF Series, or equal.

2.09 PRODUCT DATA

Ground resistance readings specified in paragraph 16450-3.05 shall be provided in accordance with Section 01300.

PART 3 EXECUTION

3.01 GENERAL

Grounding system shall be provided in compliance with the NFPA 70 National Electrical Code (NEC). Grounding conductor shall not be used as a system neutral.

Embedded and buried ground connections shall be made by compression connectors utilizing diamond or hexagon dies and a hand compression tool for wire sizes 2 AWG and smaller and a hydraulic pump and compression head for wire sizes 2/0 AWG and larger. Alternate method allowed: exothermic welding using a remote igniter device.

Tools and dies shall be approved for this purpose; dimple compressions are not acceptable. Compression connections shall be prepared in accordance with the manufacturer's instructions. Compression-type lugs shall be used in accordance with manufacturer's recommendations. Exposed ground connections to equipment shall be made by bolted

clamps unless otherwise specified. No solder material shall be used in any part of the ground circuits.

Embedded ground conductors and fittings shall be securely attached to concrete reinforcing steel with tie wires and prevented from displacement during concrete placement.

Notify the Construction Manager two hours prior to backfilling, as each part of the grounding system installed below finished grade is complete and ready for inspection. Non-compliance shall effect the payment schedule for this work.

Grounding conductors extended beyond concrete surfaces for equipment connection shall be extended a sufficient length to reach the final connection point without splicing. Provide grounding fittings, pads, or plates as shown in the electrical details. Minimum grounding conductor extension shall be 3-feet.

Grounding conductors which project from a concrete surface shall be located as close as possible to a corner of the equipment pad, protected by rigid conduit bonded to the grounding conductors, or terminated in a flush grounding plate.

Exposed grounding conductors shall be supported by noncorrosive metallic hardware at 4-foot intervals or less. Grounding conductors for shown and future equipment shall be terminated using a equipment grounding plate.

Ground conductors entering electrical enclosures shall be bonded to a single ground bus or terminal strip in the enclosure and to metallic raceways within or terminating at the enclosure. Direct ground connections to enclosure chassis or back plate are not acceptable. Prior to making ground connections or bonds, the metal surface at the point of connection shall be cleaned.

Lightning arresters shall be directly connected to the ground grid system using lightning industry braided copper conductors, sized as specified.

Metallic sheaths or shields of shielded power cable shall be terminated by a copper ground bus provided with cable connection for connection to the grounding system.

3.02 RACEWAY GROUND

All service, feeder and branch circuit raceways shall contain a green insulated ground conductor sized per applicable NFPA 70 National Electrical Code (NEC) tables:

1. T250.66 - Grounding Electrode Conductor for Alternating-Current Systems or

2. T250.122 - Minimum Size Equipment Grounding Conductors for Grounding Raceways and Equipment.

Metallic conduits terminating at concentric knock-outs or reducing washers shall be bonded using insulated grounding bushings. Grounding bushings shall be connected to the grounding system using conductors sized in compliance with NEC.

Cable trays shall have 2/0 or 4/0 bare copper ground conductor run on the outside of each tray or tray group of tiered cable tray. Conductor shall be connected to each section or fitting using an approved ground-clamp and supported at 5 foot intervals.

3.03 EQUIPMENT AND ENCLOSURE BONDING

Electrical distribution and utilization equipment enclosure ground bus, motor frames, manholes, metal structures and buildings, outdoor metal enclosures, fences and gates shall be bonded to the grounding system with conductor sizes as specified.

Connect the conductor to the metal enclosure using a UL listed connector, where the enclosure does not contain an internal ground bus

Non-electrical equipment with metallic enclosures, that are located outdoor and without a cover or a shade, shall be connected to the grounding system.

3.04 ISOLATED GROUNDING

An isolated ground system shall be installed where required by an equipment manufacturer. The isolated ground conductor shall have green insulation with a yellow stripe and shall be run in the same raceway as the power and neutral conductors. The isolated ground bus shall be kept isolated from neutral and grounding buses.

Where specifically directed by the Engineer and required by an equipment manufacturer, the Contractor shall provide an additional isolated ground conductor from the service or separately derived system to an isolated ground bus bar at each associated distribution point.

3.05 SERVICE AND SEPARATELY DERIVED SYSTEM BONDING

A neutral bonding jumper shall be installed in only one location for each service or separately derived system. The bonding jumper shall be located at the service source or the first immediate distribution point downstream from the source. The neutral and ground buses shall be kept isolated from each other accept where the bonding jumper is installed.

3.06 GROUNDING SYSTEM TESTS

The Contractor shall test the facility grounding system and the building grounding system to determine the ground resistance. The grounding test shall be IEEE Standard 81 using the NETA Fall-of-Potential procedure. A plot of ground resistance readings for each isolated ground rod, ground mat, or ground bus shall be submitted on 8-1/2 x 11 inch size graph paper. Point-to-point resistance measurements are not acceptable.

The current reference rod shall be driven at least 100 feet from the ground rod or grid under test or as recommended by IEEE Standard 81. The measurements shall be made at 10-foot intervals beginning 25 feet from the test electrode and ending 75 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

A grounding system that shows greater than 2 ohm resistance for the flat portion of the plotted data shall be considered inadequately grounded.

The Contractor shall add additional parallel connected ground rods and/or deeper driven rods until the ground resistance measurements meet the 2 ohm requirement. Additional ground

rods will be paid for as extra work where the required numbers exceed that specified when authorized and approved by the Construction Manager.

Use of salts, water, or compounds to attain the specified ground resistance is not acceptable.

END OF SECTION

SECTION 16460 DRY-TYPE TRANSFORMERS (600 VOLTS AND LESS)

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies dry-type transformers with primary winding rated 600 volts and less used for power distribution, lighting and control purposes as specified or shown.

This section specifies mini-power centers that include the primary transformer protection, transformer, secondary protection and a circuit breaker panel in one package.

This section specifies K-Rated transformer with electro-magnetic shielding.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers
ANSI/UL 506	Specialty Transformers
NEMA ST20	Dry-Type Transformers for General Application

1.03 RATINGS AND STANDARDS

Transformers rated:

1. 10 kVA and smaller shall be single phase or as indicated.
2. 15 kVA and greater shall be 3 phase or as indicated.
3. Voltage, frequency, number of phases and kVA as indicated.
4. Conform to ANSI/IEEE C57.12.01 and ANSI/ UL 506.

PART 2 PRODUCTS

2.01 MANUFACTURERS

The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Candidate manufacturers include:

1. ABB
2. General Electric
3. Eaton Cutler-Hammer
4. Siemens
5. Square D
6. or equal.

2.02 INSULATION

Transformers temperature rise based on 40-degree C ambient temperature:

1. 15 kVA and above: Not exceed 150 degree C temperature rise.

2. below 15 kVA: Not exceed 115 degree C temperature rise.

2.03 COILS

Transformer coils:

1. Copper.
2. 15 kVA and above: impregnated with varnish.
3. 10 kVA and below: encapsulated.

2.04 WINDING CONFIGURATION

Transformers shall have electrically isolated primary and secondary windings. Primary and secondary winding configurations shall be as specified or shown. Provisions shall be made to permit separate grounding of the neutral conductor and the enclosure. Single-phase transformers shall be the four winding type.

2.05 TRANSFORMER TAPS

Transformers 15 kVA and above shall be provided with two 2-1/2 percent full capacity taps above normal voltage and four 2-1/2 percent full capacity taps below rated voltage on the primary winding.

2.06 TERMINAL COMPARTMENTS

Terminal compartments shall be sized to permit termination of cables specified. Terminal connections shall be made in the bottom third of the enclosure. The terminals shall be copper and sized for the cable specified.

2.07 ENCLOSURES

Transformers enclosures:

1. 15 kVA and smaller: weatherproof, nonventilated enclosures.
2. Indoor over 15 kVA: dripproof, ventilated enclosures.
3. Outdoor: weatherproof enclosures.

2.08 MOUNTING

Transformers 25 kVA and below shall be suitable for wall mounting and include mounting brackets and hardware. Transformers over 25 kVA shall be floor mounting type.

2.09 NAMEPLATES

Nameplates shall be provided in accordance with the requirements of paragraph 16000-2.04.

2.10 SOUND LEVELS

The sound levels shall not exceed the following values:

kVA	dB
0-9	40
10-45	42
50-450	45
225-300	50
500	54

2.11 MINI-POWER CENTERS

Mini-power center (MPC) consists of an encapsulated dry-type transformer, primary and secondary main circuit breakers, and secondary panelboard all in one enclosure.

A. TRANSFORMER RATING:

KVA, primary voltage, secondary voltage, frequency and number of phases shall be as shown on the Drawings.

B. BRANCH CIRCUITS:

Molded case circuit breakers, plug-in thermal magnetic type with number of poles and trip ratings as shown on the Drawings.

C. ENCLOSURE:

Weatherproof, NEMA 3R.

D. MANUFACTURER:

1. ABB
2. Acme Electric Corporation
3. Eaton Cutler Hammer

4. Siemens
5. Square D Company.
6. or equal

2.12 NON-LINEAR LOAD K-FACTOR RATED TRANSFORMER

A. TYPE:

100 percent non-linear load rated specifically designed to handle non-linear loads with double size neutral for harmonic load.

B. K FACTOR: K= 13

2.13 SHIELDED ISOLATION TRANSFORMER

Provide self-cooled two winding type transformer with electrical ratings as shown.

Provide copper or aluminum metal shielding between primary and secondary windings.

Provide electro-static winding shield grounded to the transformer case.

2.14 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Manufacturer's verification that the unit has been built and tested in accordance with the specified ANSI standards.

2. Manufacturer's verification of the sound levels, if different from the specified NEMA ST20 standards.

3. Applicable operation and maintenance information as specified in Section 01730.

4. Manufacturer's product literature.

PART 3 EXECUTION

3.01 GENERAL

Bond transformer enclosures and neutrals together and connect to the ground grid.

3.02 INSTALLATION

Install transformers on walls or floors at locations shown on the Drawings. Install floor mounted transformers on raised concrete bases. Provide sufficient access and working space for ready and safe operation and maintenance.

Mount transformers so that vibrations are not transmitted to the structural parts of the building or to other equipment. Make connections to transformers with flexible conduit.

Adjust tap settings to provide proper voltage at panelboards.

Ground transformer in conformance with the National Electrical Code.

3.03 TESTING

Transformers shall be tested in accordance with Section 16030 – Electrical Acceptance Testing.

END OF SECTION

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SECTION 16470 LIGHTING AND POWER DISTRIBUTION PANELBOARDS

1.01 DESCRIPTION

Three phase, four wire 208Y/120 or 480Y/277 volt, dead front, circuit breaker type panelboard with current rating of 600-amperes or less.

Single phase, three wire 120/240 volt, dead front, circuit breaker type panelboards with current rating of 400-amperes or less.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE	Institute of Electrical and Electronic Engineers
NEMA	National Electrical Manufacturing Association
NFPA 70	National Electrical Code (NEC)
UL 50	Cabinets and Boxes
UL 67	Underwriters Laboratories, Electric Panelboards
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 1449	Surge Suppression Devices

PART 2 PRODUCTS

2.01 MANUFACTURERS

The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Candidate manufacturers include:

A. Eaton / Cutler-Hammer: PRL1a and PRL3a [Clipper Power Visor Surge Protective Device series]

B. General Electric: AQ and AD [with internal Surge Protective Devices]

C. Siemens: S1, SE, and S3 [with internal Surge Protective Devices]

D. Square D: NQOD and NF [with internal Surge Protective Devices]

E. or equal

2.02 ARRANGEMENT AND CONSTRUCTION

The front of the panel shall have concealed trim clamps and hinges. The locks shall be flush with cylinder tumbler-type with spring loaded door pulls. The fronts shall not be removable with doors in the locked position. Panelboard locks shall be keyed alike.

Gutter space shall be provided on all sides of the breaker assembly to neatly connect and arrange incoming wiring.

Panelboard shall be composed of individually mounted circuit breakers designed to be removable without disturbing other breakers.

A directory holder with clear plastic plate and metal frame shall be mounted on the inside of the door.

2.03 BUS

Bus shall be tin-plated copper and shall have current ratings as shown on the panelboard schedules, sized in accordance with UL 67. Ratings shall be determined by temperature rise test.

The minimum bus size shall be 100 amperes. Panel fault withstand rating shall be not less than the interrupting rating of the smallest circuit breaker in the panel. Series rating is prohibited.

Panelboards shall be provided with a separate ground bus and, where specified, with a full capacity neutral bus. The neutral bus shall be mounted on insulated stand-offs.

2.04 CIRCUIT BREAKERS

Circuit breakers shall be molded-case type provided for the current ratings and pole configurations specified on the panelboard schedule. Circuit breakers shall be bolt-on type. Circuit breakers shall be listed in accordance with UL 489 for the service specified. Load terminals of circuit breakers shall be solderless connectors.

Circuit breakers rated 120/208 volt and 120/240 volt alternating current shall have a minimum interrupting current rating of 18,000 amperes symmetrical at 240 volt AC.

Circuit breakers rated 277/480 volt alternating current shall have a minimum interrupting current rating of 25,000 amperes symmetrical at 480 volt or as specified on the panelboard schedule.

Provide circuit breakers with special features such as ground fault interrupting (GFI), heating air conditioning and refrigeration (HACR) rating, or locking capability as shown on the Drawings or Schedules.

2.05 FINISH

Panelboard cabinet shall be fabricated from hot-dip galvanized steel in accordance with UL 50. Panelboard fronts shall have a gray, baked enamel finish.

2.06 NAMEPLATES

Nameplates shall be provided in accordance with the requirements of Section 16000.

2.07 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Manufacturer's certification that bus bracing is capable of withstanding the specified short circuit condition.

2. Operations and maintenance information as specified in Section 01730.

3. Quantity and rating of circuit breakers provided with each panelboard.

PART 3 EXECUTION

3.01 GENERAL

The Contractor shall type in the circuit description on the circuit directory as shown on the final record drawings or panelboard schedule.

Provide “Circuit Directory and Circuit Identification” in accordance with NEC 408.4. Each circuit shall be of sufficient detail to allow each circuit to be distinguished from other circuits. Circuit identification shall include load location and provide equipment or instrument Tag Number and Tag Description, where shown on the drawings.

3.02 TESTING

Panelboards shall be tested for proper operation and function.

3.03 SCHEDULE

Panelboards are scheduled in drawings.

END OF SECTION

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SECTION 16500 LUMINAIRES

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies light emitting diode (LED) indoor and exterior lighting fixtures, features and installation. Non-LED lighting is included in SECTION 16500 LUMINARIES.

Terminology used in this Section conforms to the following definitions: Nomenclature and Definitions for Illuminating Engineering Lighting terminology as defined in Illuminating Engineering Society IES RP-16-17.

1.02 QUALITY ASSURANCE

A. REFERENCES STANDARDS:

This Section incorporates by reference the latest revisions of the following documents as part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

References to documents shall are in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall be the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document, before it was discontinued.

Reference	Title
NFPA 70	National Electrical Code (NEC)

B. SPECIAL WARRANTY: Provide a Special Warranty for LED lighting that shall include the following:

1. The written 5-year on-site replacement includes parts, material, fixture finish and workmanship. Provide on-site fixture replacement includes transportation, removal, and installation of new products.
2. The fixture finish shall include failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading.
3. The replacement material warranty shall include defective or non-starting LED source assemblies and on power supply units.
4. The replacement warranty shall include lighting fixtures producing inadequately maintained illuminance levels at the end of the warranty period, as prorated from levels expected at end of useful life.
5. The warranty period shall begin on the date of Substantial Completion.
6. The Contractor shall provide the Owner with appropriate signed 5-year warranty certificates.
7. The Owner shall receive these certificates prior to final payment.

1.03 SUBMITTALS

A. PROCEDURES: SECTION 01300 – SUBMITTAL.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.
2. Manufacturer's descriptive catalog literature for all lighting fixtures and accessories being installed under this section. Catalog information describing fixture make, materials, and dimensions.
3. Information shall include manufacturer, wattage, voltage, mounting configuration, and lamp type. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.
4. Submit applicable data as specified in SECTION 01730 – OPERATING AND MAINTENANCE DATA.
5. Lighting fixture model numbers are provided on the drawings in the lighting fixture schedule. The manufacturer's catalog numbers listed are examples of the basic model or series.
6. Referenced catalog numbers may not include voltage, mounting style, modifications, and other special features that are specified. The Contractor, supplier, and manufacturer shall provide the specified requirements.
7. The Contractor may propose an alternate luminaire for approval; however, sufficient information shall be provided as a part of the submittal for the Engineer and the Owner to review and compare the listed luminaire and the proposed alternate.
   a. The Contractor and lighting supplier shall provide a photometric, energy usage (efficiency), approvals/listings and materials comparison between the two fixtures.
   b. If an alternate lighting fixture layout is required, the Contractor and lighting fixture supplier shall provide all illuminance calculations as part of the submittal to verify minimum illuminance levels are met by the proposed revisions.
   c. Proposed alternates shall be shown to be equivalent or superior to the fixture listed. It shall be the Contractor’s responsibility to provide sufficient information to the Engineer and the Owner to verify and approve alternates.

PART 2 PRODUCTS

2.01 GENERAL

A Lighting materials, including fixtures, accessories, and hardware, shall conform to the requirements specified on the Lighting Fixture Schedule on the project drawings.

B. Lighting fixtures shall be provided where shown on the drawings. The drawing’s light fixture placement is diagrammatical. The fixture layout shall be coordinated with the various trades to provide access to the fixture and to avoid installed equipment interference.

2.02 LIGHTING CONTROLS

A. Per SECTION 16175 - MISCELLANEOUS ELECTRICAL DEVICES - that includes control switches, selector switches, relays, lighting contactors and other devices.

B. The project drawings indicate the operation and control methods and the circuits for the lighting systems.

2.03 LED LIGHTING

A. LED lighting shall be a functioning unit with all components including light source, lamps, power supply, control interface and components required for operation and shall be assembled by the lighting manufacturer or supplier.

B. Lighting fixtures shall be UL or ETL listed and labeled. Lighting testing shall be per IESNA LM-79 AND LM-80 procedures.

C. Lighting fixtures shall comply with ANSI chromaticity standard for classifications of color temperature. Refer to the specified LED lamp color and color temperature or the manufacturer's literature.

D. LED drivers shall have reversed polarity protection, open circuit protection and require no minimum load. Drivers shall operate at a minimum 80 percent efficiency and have a class A noise rating.

E. Where LED systems are specified to be dimmable, the LED system shall be capable of full and continuous dimming.

2.04 EXTERIOR LIGHTING POLES

A. Provide lighting poles with pole cap, hand holes, ground lug, and the necessary fixture mounting hardware.

B. TYPE:

1. Site/Area poles as shown on the contract drawings:
   a. Shape: round, square, tapered, straight
   b. Material: Steel, concrete, aluminum, wood
   c. Finish: galvanized, powder coated
   d. Height: 6', 10', 15', 20', 30' examples
   e. Options: tall pole breakaway, selector switch such as HOA where Auto mode may be a photocell, and GFI receptacle may also be required on a pole where shown.
2. Stanchion poles:
   a. In Class I, Div. 1 areas provide pole as detailed and specified on the drawings.
   b. In Class I, Div. 2 and unclassified areas provide a telescoping light pole. Pole shall meet the sub-sequent requirements.
   c. Construction:
      1) Telescoping: factory sealed and pre-wired
      2) Adjustable 360 deg. pole rotation

3) Adjustable height
4) Spring assist for controlled lowering and assist to raise

d. Height: As shown; adjustable raised height
e. Certifications:
1) UL 1598
2) CSA C22.2 No. 250.0-08
3) Suitable for use in Class I, Division 2 and Class I, Zone 2 areas
f. Wind Rating: AASHTO standard; 310 mph aluminum; 230 mph stainless steel
g. Vibration: IEC 60068-2-6
h. Material: Aluminum T6061 or Stainless Steel 316 grade, as specified
i. Hardware: Xylan 1400 coated for corrosion protection
j. Cable:
1) 12/3 AWG UL/CSA Listed
2) 600V, -40 deg C to 105 deg C
3) Sun and oil resistant
4) ROHS II Reach
5) Internal conduit for cable protection
k. System shall be factory assembled and wired
l. Coordinate with fixture mounting requirements
m. Poles shall not to be handrail mounted
n. Pole shall be Eaton/Crouse Hinds V-Spring system or approved equal.
o. Model V65BA -A; top hat and fitting mounts shall be provided as required for fixtures.
p. Provide optional “J” bolts as required for wind requirements in the area.

2.05 SITE JUNCTION BOXES

A. Provide a minimum of one junction box for the distribution of outdoor lighting circuits within ten feet of building and as required. Boxes shall be precast concrete, set flush with the ground. Size shall be approximately 10 x 16 x 12 inches deep.

B. Lid shall be cast iron with permanent inscription: "LIGHTING". Boxes shall be Brooks Products, Oldcastle Precast, Forni Corporation, Utility Vault Company, Christy Concrete Products, or equal.

C. Examples: Jensen Precast Pull Boxes 10” x 17”, Oldcastle, Brooks Products, Christy, J&R, Caltrans. HT = High Traffic Pull Box.

D. Circuit’s raceways and conductors shall be terminated and spliced, respectively at new junction box. Provide watertight U.L. Listed splices for the circuits.

2.06 PHOTOELECTRIC CELL UNITS

A. Photoelectric cell units shall in a plug receptacle assembly.

B. The plug receptacle assembly shall be three-prong polarized locking type.

C. Assembly shall be suitable for outdoor mounting.

PART 3--PRODUCTS

3.01 GENERAL

A. The location and type of light fixtures and control are shown on the drawings.

B. Lighting circuit raceways and conductors shall be sized by the contractor, where the circuits are not shown on the drawings.

C. Raceways and wire shall be provided from the fixtures and switches to the lighting panel in accordance with the NEC.

D. Raceways shall be provided in accordance with SECTION 16110 - RACEWAYS, BOXES, AND SUPPORTS.

E. Circuit wire shall be provided in accordance with SECTION 16120 - 600 VOLT CONDUCTORS, WIRE, AND CABLE.

F. Fixtures labeled to require conductors with a temperature rating exceeding 75 degrees C shall be spliced to circuit conductors in a separately mounted junction box. Fixture shall be connected to junction box using flexible conduit with a temperature rating equal to that of the fixture.

G. Labels and marks, except the UL label, shall be removed from exposed parts of the fixtures. Fixtures shall be cleaned when the project is ready for acceptance.

H. Where recessed fixtures are required, the fixture shall be provided with mounting hardware for the ceiling system specified.

I. A concealed latch and hinge mechanism shall be provided for access to the lamps and ballasts and for removal and replacement of the diffuser without removing the fixture from ceiling panels.

J. Fixtures recessed in concrete shall have protective coating of bituminous paint.

K. Fixtures shall be aligned and directed to illuminate an area as specified.

L. Fixtures shall be directly and rigidly mounted on their supporting structures.

M. Conduit system shall not be used to support fixtures.

N. Where brackets or supports for lighting fixtures are welded to steel members, the welded area shall be treated with rust-resistant primer and finish paint.

O. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values or use torque values specified in UL 486A and UL 486B.

P. Verify normal operation of each fixture.

Q. Interrupt the power supply to demonstrate emergency lighting operation to battery power source or alternate power source. Retransfer to normal power supply.

R. Replace damaged fixtures.

S. Photoelectric cells, where specified, shall be oriented toward the north.

3.02 LUMINARIE FIXTURE SPECIFICATIONS

Refer to lighting schedule included in project drawing for specific luminaire fixture designations for various installations within the scope of this project.

END OF SECTION

SECTION 16920 600 VOLT MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies freestanding, factory assembled 600 (480) volt Motor Control Centers (MCC) with digital power monitors to display the voltage and current load parameters.

B. The MCC shall have an Arcflash Reduction Maintenance System (ARMS) feature for arcflash reduction, or equivalent, no exceptions.

C. EQUIPMENT LIST:

MCCs specified herein shall be furnished by a single manufacturer.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/NEMA ICS 1	Industrial Control Systems: General Requirements
ANSI/NEMA ICS 18	Motor Control Centers
NFPA 79	Electrical Standards for Industrial Machinery
UL 845	Motor Control Centers

B. CODES AND STANDARDS

Motor Control Centers and all components shall be Underwriters Laboratory listed to UL 845 and shall conform to NEMA ICS-1 and ICS-18 standards.

1.03 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

1. A copy of this 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. A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. Elementary connection and interconnection diagrams as required in paragraph 16920-2.07, in accordance with NFPA 79 and/or NEMA ICS 18 Part 1 standards.
3. List of starters and feeder tap compartments indicating the size and type of circuit protection.

4. Interrupting, withstand, and continuous current rating of:

    a. Bus bars
    b. Feeder tap units
    c. Starter units
    d. Main incoming units

5. Nameplate schedule

6. Dimensioned drawings showing conduit access locations

7. Front view elevation with starter and component schedule

PART 2 PRODUCTS

2.01 MANUFACTURERS

The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Motor Control Centers shall be as manufactured by Eaton, Square D/Schneider, ABB or equal.

2.02 SERVICE

Motor control centers shall be rated 480 volts, 60 Hertz, 3 phase, 3 wire no neutral bus as specified or indicated, suitable for operation at the specified voltages and short circuit capacities.

2.03 STRUCTURE AND CONSTRUCTION

A. STRUCTURE:

Motor control centers shall be made of No. 14 gage steel minimum and, unless otherwise shown, each section shall be 90 inches high by 20 inches wide by 20 inches deep. The individual unit compartments shall be a minimum of 18 inches high.

Each section shall have 72 inches for stacking starter units into the sections. Size NEMA 1 through 3 FVR and FVNR starter units shall be provided with an additional 6 inches of vertical space.

The compartments shall have pan-type doors with a minimum of two quarter-turn hold-down latches; and neoprene gaskets.

A full height vertical wireway, 4 inch wide minimum, but not less than 30 square inches in cross section, shall be provided for each vertical motor control center section. The wireway shall contain full height removable doors. Horizontal wireways shall be provided top and bottom, extending the length of motor control centers.

Bottom channel sills shall be mounted front and rear of the vertical sections extending the full length of the motor control center lineup. A removable lifting angle shall be mounted on top and shall extend the width of the motor control center lineup.

B. CONSTRUCTION:

Motor control centers located indoors shall have NEMA 1, gasketed enclosures.

Starter units, size 4 and smaller, and feeder tap units less than 225 amperes shall be drawout plug-in construction with hardened, tin-plated copper free-floating stabs, steel spring backups. The door shall have interference tabs which prevent door closure if unit is improperly installed.

Units shall be latched in the position to assure proper bus contact. The unit disconnect device shall be interlocked to prevent removal or reinsertion of a unit when the disconnect is in the "ON" or "TRIPPED" positions.

Fusible switch or circuit breaker disconnect operators shall be capable of accommodating three padlocks for locking in the "OPEN" position.

Hardware for mounting future starter and feeder tap units shall be provided at compartments specified as "FUTURE."

C. SEISMIC BRACING:

Motor control centers and related equipment shall conform to the seismic anchorage and bracing requirements of Section 01900. As an additional minimum requirement, the Motor Control Centers shall be braced for the latest version of the Uniform Building Code.

2.04 CONTROL SECTION

A separate vertical section shall be provided where specified and contain relays or a programmable controller as specified. The programmable controller or remote I/O equipment shall be as specified in Section 16925.

The door shall be full height and have a keyed handle with a three-point latch. All control sections shall be keyed alike.

The control section shall be completely barriered and contain an equipment mounting panel made of 10-gage steel which is supported off the back of the enclosure by mounting studs. The usable depth shall be minimum 17 inches. Width shall be 30 inches, or as specified.

Slotted plastic wire ways shall be provided as required to contain the wiring in a neat appearance.

The control section shall include a 115 Vac utility power receptacle for maintenance and an internal switched fluorescent light and provide a separate 115 Vac branch circuit for the programmable controller as shown on the Drawings

2.05 FINISH AND COLOR

The finish and color shall be in accordance with manufacturer's standard ANSI finish.

2.06 BUS

A. GENERAL:

Bus shall be tin-plated copper with bolted connections between vertical and horizontal bus bars. Access for tightening these connections shall be from the front, without the need for tools on the rear of the connection. Insulated horizontal and vertical bus barriers shall be provided. Barriers shall be fabricated from high-strength, glass-filled polyester resin.

The bus shall be braced to withstand a fault current of 65,000 amperes, RMS, symmetrical.

B. HORIZONTAL BUS:

Unless otherwise specified or shown, the main horizontal bus shall be rated a minimum 600 amperes continuous.

C. VERTICAL BUS:

Unless otherwise specified or shown, the vertical bus shall be insulated and rated a minimum 300 amperes continuous.

D. NEUTRAL BUS:

The neutral bus shall be provided and have the same rating as the main horizontal bus, where specified or shown.

E. GROUND BUS:

A 1/4-inch by 2-inch ground bus shall be provided the full length of the motor control center. Ground bus shall be located at the bottom of the motor control center. Provide a lug to terminate a bare 4/0 AWG copper ground conductors at each end of the ground bus.

2.07 WIRING

A. GENERAL:

Motor control centers shall be provided with NEMA ICS 18 Class II, Type B wiring. All starter units shall have terminal blocks for control wiring. Terminal blocks shall be provided for power wiring for starters size 2 and smaller.

Motor control centers shall be provided with all necessary interconnecting wiring and interlocking. When a MCC control section is specified on the drawings or schedules, wire directly to the relays or programmable controller's input/output modules as part of the interconnecting wiring.

Provide elementary and connection diagrams for each starter unit and an interconnection diagram for the entire motor control center.

B. POWER WIRE:

Power wire shall be copper 90 degrees C insulated, sized to suit load; minimum power wire size shall be No. 12 AWG copper stranded.

C. CONTROL WIRE:

Control wire shall be No. 16 AWG stranded copper wire, rated 90 degrees C machine tool wiring (MTW) and UL listed for panel wiring.

D. TERMINATIONS AND CABLE CONNECTIONS:

1. TERMINALS: Control wiring shall be lugged with ring-tongue or locking spade crimp type terminals made from electrolytic copper, tin-plated.

2. CABLE CONNECTORS: Cable connectors for use with stranded copper wire, sizes No. 8 AWG to 1000 kCmil shall be UL listed. Dished conical washers shall be used for each bolted connection. Connectors shall be reusable and shall be rated for use with copper conductors. Incoming line and outgoing feeder compartments shall be provided with crimp type lugs, 3M Company, Burndy Company, or equal.

E. CONDUCTOR MARKERS:

Markers used for identification shall meet the requirements of Section 16000.

2.08 MAIN AND FEEDER CIRCUIT PROTECTION

A. GENERAL:

Main and feeder tap units shall consist of fused disconnect switches or circuit breakers, as specified or shown. Series ratings for overcurrent devices to meet specified short circuit withstand ratings is prohibited.

B. FUSED DISCONNECT SWITCHES: NOT USED

C. CIRCUIT BREAKERS (THERMAL MAGNETIC):

Thermal-magnetic circuit breakers shall be molded case equipped with toggle type handle, quick-make, quick-break over center switching mechanism that is trip-free so that breaker cannot be held closed against short circuits and abnormal currents. The tripped position shall be clearly indicated by breaker handle maintaining a position between "ON" and "OFF." All poles shall open, close, and trip simultaneously. Minimum short circuit capacity shall be 65,000 amperes symmetrical.

D. CIRCUIT BREAKERS (MAGNETIC ONLY):

Magnetic circuit breakers shall be molded-case equipped with toggle type handle, quick-make, quick-break over center switching mechanism that is trip-free so that breaker cannot be held closed against short circuits and abnormal currents. The tripped position shall be clearly indicated by breaker handle maintaining a position between "ON" and "OFF." All poles shall open, close, and trip simultaneously. Minimum short circuit capacity shall be 65,000 amperes symmetrical.

2.09 MOTOR STARTER UNITS

A. GENERAL:

Motor starter units shall be combination type with contactor and fused disconnect switch, thermal magnetic circuit breaker, or motor circuit protector, and solid-state overload unit as indicated on the drawings or specified in the MCC schedule. The starter units shall have a minimum combination UL listing of 65,000 amperes RMS symmetrical or as indicated or specified in the schedule.

B. FUSED DISCONNECT SWITCHES: NOT USED

C. MOTOR CIRCUIT PROTECTORS:

The molded case motor circuit protector (MCP) shall operate on the magnetic principle with a current sensing coil in each of the three poles to provide an instantaneous trip for short circuit protection. The trip setting shall be adjustable from 700 to 1300 percent of the motor full load amperes from the front of the MCP. The motor circuit protector shall be set at its lowest position at the factory.

D. CONTROL TRANSFORMERS:

Each control transformer shall be rated 480/240-120V, single phase, 2-wires, 60 Hertz. The transformer shall be sized for the load it feeds but shall not be less than the minimum ratings as follows:

NEMA starter size	Minimum transformer volt-ampere rating
1	100
2	150
3	200
4	300

Each control transformer shall be provided with time-delay, slow-blow secondary fuse rated to interrupt 10,000 amperes short circuit at 250 volts AC. Two primary fuses rated to interrupt 200,000 amperes at 600 volts shall be provided on all starters.

Fuse holder for secondary fuse shall be drawout indicating type and mounted on the door of the compartment. Fuse holders for primary fuses shall be fuse clips with full barriers between fuses.

E. CONTACTORS:

Unless otherwise specified or shown, contactors shall be full voltage, 3-pole, 600 volt AC, NEMA Size-1 minimum. Contacts shall be double break, silver-cadmium oxide, and weld resistant. Contacts shall be isolated to prevent arcing. Coils and magnets shall be capable of being removed or replaced without special tools. IEC contactors are prohibited.

Reversing, multispeed, and reduced voltage starters shall have additional contactors, overload relays, and auxiliary relays as required, and shall have mechanically interlocked contactor coils to prevent simultaneous engagement.

F. TRANSIENT VOLTAGE SURGE SUPPRESSOR:

Provide metal oxide varistor (MOV) surge protective device (SPD) integral within each motor control center that indicates the status and condition of the SPD, tested per NEMA LS-1, rated IEEE C3 Combined Wave of 20kV and 10kA with 200kAIC internal fusing and listed / labeled per UL 1449. Minimun surge rating: 160kA per phase.

Provide a factory selected transient surge suppressor rated for each motor starter and power contactor encapsulated in a small module and mounted directly to the starter or contactor coil.

G. AUXILIARY CONTACTS:

Contactors shall be equipped with auxiliary contacts, rated 10 amperes at 120 volts AC. Refer to drawings for actual quantities required. As a minimum, each contactor shall be equipped with two normally open and two normally closed electrically isolated auxiliary contacts with the used and auxiliary contacts wired out to terminal blocks.

H. OVERLOAD RELAY:

The solid-state overload relay shall protect the power wiring and motor from excessive overcurrents. The relay shall be ambient compensated and have adjustment from 90 to 110 percent of the normal rating.

The sensing element shall be adjustable Class 20 tripping time of 20-seconds at 600-percent of current setting. The faster overload trip Class 10 (10-seconds at 600-percent of current setting) and the longer overload trip Class 30 (30-seconds at 600-percent of current setting) shall be field set by the installer during the driven equipment startup with the overload settings that are required by the type of motor driven load.

I. TERMINAL BLOCKS:

Terminal blocks shall be screw type rated 600 volts; 20 amperes for control wiring and 30 amperes power wiring with starters Size 3 and larger shall terminate the power leads directly to the contactor.

The number of terminal blocks shall be specified on the drawings. Terminal blocks shall be provided with integral marking strips and shall be permanently marked with the conductor number as specified on the drawings. Internal wiring shall be connected on one side of the terminal block; outgoing conductors shall be connected to the other side.

2.10 MISCELLANEOUS

A. GENERAL:

Control devices such as pushbuttons, selector switches, indicating lights and overload reset pushbuttons shall be mounted on the unit compartment door.

The control devices shall comply with the requirements of Section 16175.

B. ELAPSED TIME INDICATOR:

Where shown or specified, the elapsed time indicator shall be as specified in Section 16175. The indicator shall be mounted on the unit compartment door.

C. NAMEPLATES:

Nameplates shall be provided in accordance with the requirements of Section 16000. Nameplates shall be provided for all cubicles and compartments and identify the load per NEC. Nameplate shall be provided identifying the motor control center. Provide equipment tag numbers and descriptions as shown.

2.11 SPACE HEATERS AND THERMOSTATS

Motor control centers located outdoors or in a corrosion rated area shall be provided with space heaters and thermostats to maintain the interior temperature at more than 45 degrees F. Space heaters and thermostats shall be rated 120 volts AC. Space heater shall be powered from a control power transformer.

Where indicated, the space heater circuit shall be wired to terminal blocks to facilitate the connection of an external power supply when the MCC is in storage. Provide a disconnect for isolation of the external power supply.

2.12 DRY-TYPE TRANSFORMERS

Dry-type energy efficient power transformers shall meet the requirements of Section 16460 The size and voltage shall be as specified.

2.13 PANELBOARDS

Where specified, panelboards mounted in motor control centers shall be flush mounted and shall have the quantity and size of branch circuit breakers specified. The panelboard shall meet the requirements of Section 16470 MCC standard product with 20 ampere breakers.

2.14 NOT USED

2.15 NOT USED

2.16 SPARE PARTS

One set consisting of the following spare parts shall be provided:

1--set each fuse size and type
10--indicating light bulbs

2.17 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Manufacturer's certification that the following items are capable of interrupting and/or withstanding the specified short circuit condition:

    a. Bus bar bracing
    b. Feeder tap units
    c. Starter units

2. Operation and maintenance information as specified in Section 01730.

3. Dimensions and weights.

4. Installation instructions.

5 Manufacturer's product data.

6. Manufacturer's certification and calculations confirming that the equipment complies with the seismic anchorage and bracing requirements of Section 01900 and paragraph 16920-2.03 C.

PART 3 EXECUTION

3.01 GENERAL

The motor control centers shall be erected in accordance with the recommendations of the manufacturer and with the details specified herein.

Field wiring shall meet the requirements of paragraph 16120-3.02. Cables larger than No. 6 AWG which hang from their vertical connections shall be supported within 2 feet of the connection.

The solid-state overload relay settings shall be implementned by the Contractor with the settings selected based on the actual full load amperes of the motor connected to the starter and the requirements of the motor driven equipment. Refer to the manufacturer's literature for setting the overload relays. Refer to the overload relay paragraph 16920-2.09H for the setting options that available in the overload relay.

The motor circuit protectors shall be adjusted by the Contractor to the lowest setting not causing false tripping.

Install motor control centers level and plumb on 3-1/2-inch concrete housekeeping pads per the manufacturer's installation instruction.

3.02 FIELD TESTS

Motor control centers shall be tested in accordance with Section 16030.

3.03 MCC SCHEDULES

Motor control centers are scheduled in Section 16994.

END OF SECTION

SECTION 17000 GENERAL REQUIREMENTS FOR INSTRUMENTATION AND CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies general requirements which are applicable to providing a complete, functional process control system for the Master LS N1B Rehabilitation. The requirements of this section are applicable to all work specified in Division 17 of these specifications.

Electrical requirements applicable to this work include those specified in Section 16000 for general electrical requirements.

B. DESCRIPTION OF WORK:

1. INSTRUMENTATION AND CONTROL SYSTEM: The Master Lift Station Building currently has an existing RTU (RTU090) with a Dataflow TCU controller to start and stop the (3) Lift Station Influent pumps. The Pumps operate with VFDs. The existing RTU090 shall be relocated to the new electrical building. The existing RTU090 control panel cabinet shall be replaced with new cabinet (install cabinet of same dimensions and features as existing; include new nameplate). See Figure 1 below in section 2.01B of this specification.The existing RTU090 subpanels and control equipment shall be installed in the new control panel cabinet. Contractor shall replace existing UPS batteries with new and provide new Panduit, terminals, wiring, etc. as required to make RTU090 fully functional after relocation/cabinet replacement. RTU090 communicates to the remote Plant SCADA via an existing antenna/radio communications. New coax cable shall be installed between the relocated RTU090 and the existing antenna. The existing diminutor and associated control panel shall be replaced with a new Grinder and a new vendor supplied Grinder Control Panel. The New Grinder Control Panel (NR09-VCP-201) shall be located in the new Electrical Building. The contractor shall supply and install a new magnetic flowmeter. The existing RTU090 field I/O wires shall be disconnected and the RTU terminals shall be carefully documented for ease of relanding the new field I/O wires. New field I/O wires from both the existing equipment and the new equipment shall be labeled on both ends and terminated to the respective terminals in RTU090. Refer to Drawing I-10-601 for I/O signals.

   The Contractor shall verify and test all of the terminations including antenna coax terminations to provide a fully functional system. After all of the field I/O is terminated and verified, the Contractor shall coordinate with the Owner to demonstrate that RTU090 is operating the same way as it did prior to the upgrades. RTU090 to SCADA communications shall be verified and demonstrated. The Contractor shall prepare a construction sequence plan to remove the existing systems and keep systems running as required by the Owner, while the new systems are built. The contractor shall provide new interconnection diagrams with new cable identifications, no exceptions.

2. PROGRAMMING: No programming updates required to RTU090.

C. DEFINITIONS:

1. GENERAL: Definitions of terminology related to Instrumentation and Industrial Electronic Systems used in the specifications shall be as defined in IEEE 100, ISA S51.1, and NEMA ICS 1.

2. TWO-WIRE TRANSMITTER: A transducer which derives operating power supply from the signal transmission circuit and requires no separate power supply connections. A two-wire transmitter produces a 4 to 20 milliampere current regulated signal in a series circuit with a 24 volt direct current driving potential and a maximum circuit resistance of 600 ohms.
3. FOUR-WIRE TRANSMITTER: A transducer which derives operating power from separate power supply connections. A four-wire transmitter produces a 4 to 20 milliampere current regulated signal in a series circuit with a maximum circuit resistance of 600 ohms. Four-wire transmitters typically require 120Vac or 24Vdc input power supply.

4. GALVANIC ISOLATION: Electrical node having no direct current path to another electrical node. Galvanic isolation refers to a device with electrical inputs and/or outputs which are isolated from ground, the device case, the process fluid, and separate power supply terminals. Inputs and/or outputs may be externally grounded without affecting the characteristics of the devices or providing path for circulation of ground currents.

5. PANEL: An instrument support system which may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems including consoles, cabinets and racks. Panels provide mechanical protection, electrical isolation, and protection from dust, dirt, moisture, and chemical contaminants which may be present in the atmosphere.

6. DATA SHEETS: Data sheets shall refer to ISA S20 or ISA TR20.00.01.

7. SIGNAL TYPES: Used in systems specified in Division 17:

    a. LOW-LEVEL ANALOG: Signal with full output level of 100 millivolts or less including thermocouples and resistance temperature detectors.

    b. HIGH-LEVEL ANALOG: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4 20 mA transmission.

    c. DIGITAL CODE: Coded information from the output of an analog to digital converter or digital transmission terminal.

    d. PULSE FREQUENCY: Counting pulses emitted from speed or flow transmitters.

    e. MODULATED SIGNALS: Signals from modems or low level audio signals. Normal signal level: plus 4 dBm to minus 22 dBm. Frequency range is 300 to 10,000 Hertz.

    f. DISCRETE CONTROL OR EVENTS: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits.

g. LOW VOLTAGE DISCRETE CONTROL OR EVENTS: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits operating at less than 30 volts and 250 milliamperes.

h. HIGH-LEVEL AUDIO SIGNALS: Audio signals exceeding plus 4 dBm, including loudspeaker circuits.

i. RADIO FREQUENCY SIGNALS: Continuous wave alternating current signals with fundamental frequency greater than 10 kilohertz.

8. SYSTEMS INTEGRATOR: A firm engaged in the business of detailed control system design and engineering, instrumentation component purchase, system and panel assembly, programming, and implementing the specified process control and industrial automation systems.

1.02 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).

If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE 100	Standard Dictionary of Electrical and Electronics Terms
ISA S5.4	Instrument Loop Diagrams
ISA S20	Specification Forms For Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S51.1	Process Instrumentation Terminology
ISA TR20.00.01	Specification Forms for Process Measurement and Control Instruments Part 1: General Considerations
NEMA ICS 1	General Standards for Industrial Control and Systems

B. SYSTEMS INTEGRATOR RESPONSIBILITY:

1. GENERAL

a. The specified control system and instrumentation integration including instrument calibration, testing, start-up, operational testing, and training shall be performed by a Systems Integrator staffed with qualified personnel, possessing necessary equipment and experience in performing similar installations.

b. The overall system performance shall be demonstrated to and accepted by Owner.

2. SYSTEMS INTEGRATOR QUALIFICATIONS:

a. The following Systems Integrators are pre-qualified to perform the work specified in Division 17 without the need to provide Evidence of Experience:

1) BCI, Tampa FL
2) CEC, Warren Michigan
3) Curry Controls, Lakeland FL
4) Southern Flow, Alpharetta, GA
5) Revere Controls, Birmingham AL

b. Contractor-proposed PCSI shall be evaluated based on submittal of the following Evidence of Experience:

1) Submit evidence of experience in performing three similar successful projects in the last five years with one project currently in progress or competed within the last two years.

2) Submit project descriptions with contact names, addresses, and telephone numbers from the project Owner, General Contractor, and Principal Design Firm.

3) Submit organization chart and resumes for proposed project personnel.

4) Submit Training and Certification information. Completion of the following training courses or appropriate portions thereof or possession of the following certifications included with the Systems Integrator's personnel experience requirements described above:

a) Project manager: Control System Engineer (CSE) registration, Professional Engineer (PE) registration.

b) Systems engineer: Control System Engineer (CSE) registration, Professional Engineer (PE) registration, or completion of the relevant core courses in the Engineering Skills Training program.

c) Programmer: Control System Engineer (CSE) registration, Professional Engineer (PE) registration.

d) Field instrument technician: Certified Control Systems Technician (CCST) registration or completion of the relevant core courses in the Technical Skills Training program.

e) Certified training programs, as offered by ISA.

5) Submit financial data for Systems Integrator division when subsidiary to a parent corporation. Include two years of financial data.

a) Financial Statement.

b) Balance Sheet.

c) Dun & Bradstreet Report.

3. PRE-SUBMITTAL CONFERENCE: NOT REQUIRED

C. PROCESS EQUIPMENT COORDINATION

1. Division 17 specified equipment shall be coordinated for proper operation with equipment related process equipment specified in other Divisions.

2. Equipment shall be integrated, furnished, and installed in conformance with the drawings, specifications, and the recommendations of the equipment manufacturer and the related processes equipment manufacturers.

3. Systems Integrator shall obtain manufacturer's technical information for items of equipment not provided with, but directly connected to, the control system. Provide the necessary coordination and components for correct signal interfaces between specified equipment and the control system.

4. Systems Integrator shall coordinate with project subcontractors and equipment suppliers.

5. Systems Integrator shall provide installation supervision for the duration of the project.

6. Conflicts between the plans, specifications, manufacturer/vendor drawings and installation instructions, etc., shall be presented to the Construction Manager for resolution before proceeding.

D. FACTORY ACCEPTANCE TEST (FAT): NOT USED

1.03 ENVIRONMENTAL CONDITIONS

A. GENERAL:

Specified data communication and process control equipment shall suitable for operation in indoor locations and in outdoor locations. Ambient conditions are specified in Section 01800.

B. CORROSIVE LOCATIONS:

Corrosive locations shall be as specified in Division 16.

C. HAZARDOUS (CLASSIFIED) AREAS:

Hazardous areas shall be as specified in Division 16.

D. SEISMIC:

Equipment and supports shall be braced per Section 01900.

1.04 FUNCTIONAL REQUIREMENTS

A. GENERAL:

The instrumentation and control system functions are shown on the drawings and specified in subsequent sections of Division 17. The Systems Integrator drawings and integration practices shall be as defined in IEEE 100, ISA S51.1, and NEMA ICS 1.

B. SUBMITTAL DRAWINGS:

1. GENERAL: The drawings included in the project manual are functional in nature and do not show exact locations of equipment or interconnections between equipment. The Contractor's Systems Integrator shall prepare detailed installation drawings as specified below.

Drawings prepared in AutoCAD version 2017 with borders and title blocks identifying the project, system, revisions to the drawing, and type of drawing. Each revision of a drawing shall include the date and description of the revisions. Drawing prints shall be 11" x 17" with a minimum lettering size of 1/8".

Diagrams shall carry a uniform and coordinated set of wire numbers and terminal block numbers in compliance with panel wiring, Section 16176 and Section 17110, to permit cross-referencing between contract documents and the drawings prepared by the Contractor.

2. CONNECTION DIAGRAMS: Not Used

3. INTERCONNECTION DIAGRAMS: Show panels, panel devices, and field devices with wire numbers, cable numbers, raceway numbers, terminal box numbers, terminal block numbers, panel numbers, and field device tag numbers.

4. ELEMENTARY OR SCHEMATIC DIAGRAM: Not Used

5. ARRANGEMENT, LAYOUT, OR OUTLINE DRAWINGS: Not Used

6. NETWORK BLOCK DIAGRAM: Not Used

1.05 SUBMITTALS

The following information shall be provided in accordance with and Section 01300:

1. A copy of this 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. A check mark shall denote full compliance with a paragraph as a whole.

   If deviations from the specifications are indicated, and therefore requested by the Contractor, each requested deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

   The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

   Failure to include a copy of the marked-up specification sections, along with justification for requested deviations from the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Detailed product literature, showing product specifications and model number breakdown. Mark to denote features and options included. Include only the applicable pages.

3. Manufacturer's installation manual excerpts, as to be used for this project:

   a. Installation details/drawings.
   b. Electrical connection diagrams
   c. Calibration procedures.

4. Drawings and diagrams specified in paragraph 17000-1.04 B.

5. Nameplate list with material, tag number and description as specified herein.

6. Systems Integrator Evidence of Experience per paragraph 17000-1.02 B 3.

7. Data Sheets in accordance with ISA 20 for each instrument. Identical instruments may be submitted with one common ISA Data Sheet and accompanying tag list.

   Review the submittal requirements specified in other Division 17 Sections.

PART 2 PRODUCTS

2.01 GENERAL

A. MATERIALS AND QUALITY:

Equipment material shall be new, free from defects, and industrial-grade, as specified. Each type of instrument, instrument accessory, and device used throughout the work shall be manufactured by one firm, where possible.

Electronic equipment shall be of solid-state construction with printed or etched circuit boards of glass epoxy of sufficient thickness to prevent warping.

B. ENCLOSURES:

Table A specifies the instrument and control panel enclosure material and minimum NEMA rating for the location and application.

Table A

Location	Enclosure Material and NEMA Rating
Indoor: Architecturally Finished Area	NEMA 12: mild steel
Indoor: Electrical Room	NEMA 12: mild steel
Indoor: Process Areas	NEMA 4X: 316 Stainless Steel
Indoor: Corrosive Area	NEMA 4X: 316 Stainless Steel
Outdoor: Corrosive Area	NEMA 4X: 316 Stainless Steel
Outdoor: Non-Corrosive Areas	NEMA 4X: 316 Stainless Steel
Corrosive Area (Hypochlorite)	NEMA 4X: Non-metallic
Hazardous Area:	NEMA 7: Galvanized Malleable Iron or Aluminum or NEMA 4X and UL listed or FM Approved for the Hazardous Area.
Hazardous and Corrosive Area	NEMA 7: Iron or Aluminum with factory applied corrosion resistant coating or NEMA 4X and UL listed or FM Approved for the Hazardous Area.

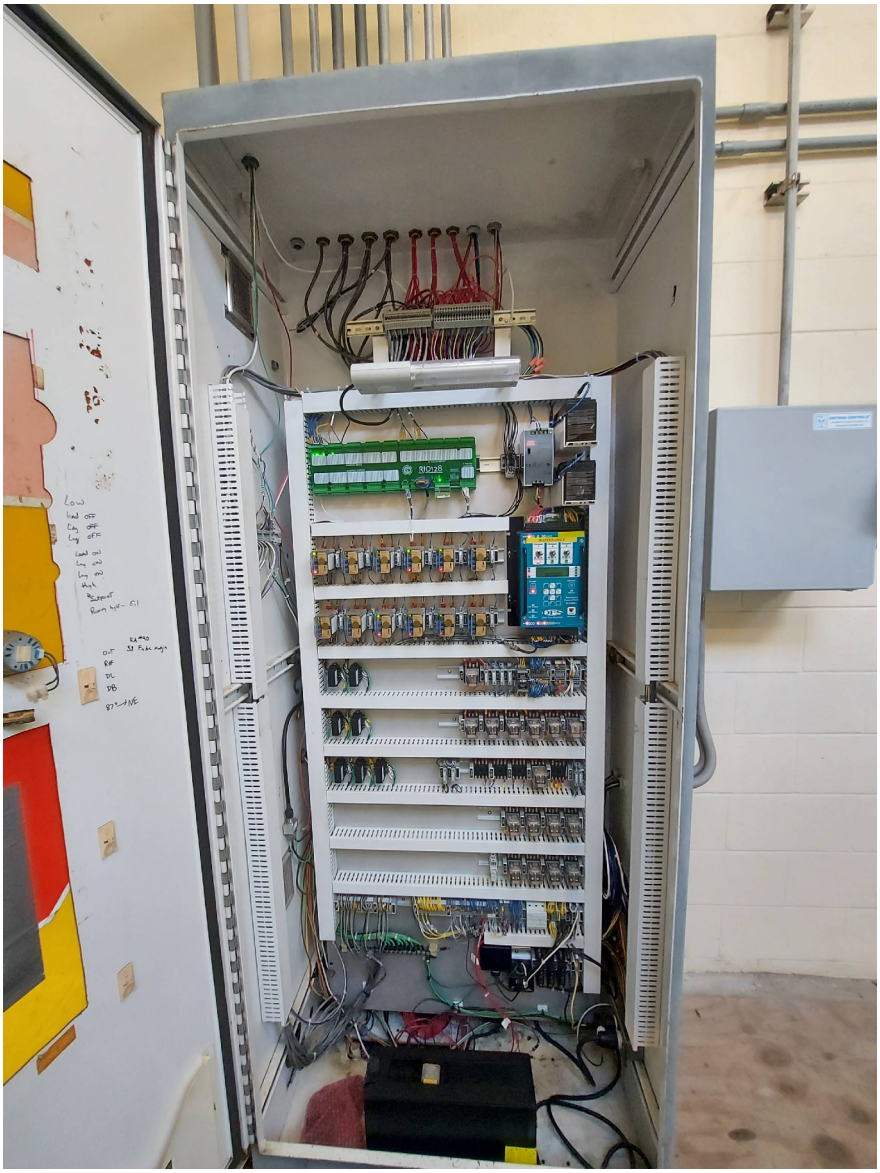

Figure 1: Existing RTU090

2.02 NAMEPLATES

Nameplates shall be provided for all field mounted instrument, analyzer, or equipment specified in Division 17. Provide new nameplate for new RTU090 cabinet. Nameplate lettering shall include the equipment or instrument loop title and the instrument or equipment tag number, where nameplate engraving is not specified or shown. Nameplates shall be machine engraved black phenolic with white 5/32-inch high lettering, as minimum, unless otherwise specified or shown. Nameplate wording may be changed without additional cost or time, if changes are made prior to commencement of engraving.

Nameplates shall be attached to support hardware with a minimum of two self-tapping type 316 stainless steel screws in a readily visible location so the nameplate will remain to identify the service when the device is removed. Field instrument namplates shall be attached with braided stainless steel straps where not stand mounted.

2.03 PRODUCT DATA

The following Product Data shall be provided in accordance with Section 01300.

1. Operating and maintenance information shall be provided in accordance with Section 01730. Include the following in each Operation and Maintenance manual:

    a. Final reviewed Submittals, including revised as-built record drawings.

    b. Manufacturer's operation and maintenance instructions, edited for this project.

    c. Written record of menu configuration, jumpers, switch settings, and other configurable parameters for each instrument.

PART 3 EXECUTION

3.01 INSTALLATION

A. GENERAL:

Equipment shall be installed in locations that are accessible for operation and maintenance services. Equipment not accessible shall be reinstalled at no cost to the Owner.

Installation, calibration, settings, and testing procedures are specified in Section 17000, Section 17200 – Instrument Index Part 3 Execution, and subsequent sections of Division 17.

B. FIELD EQUIPMENT:

Equipment shall be provided with ports and adjustable items accessible for in-place testing and calibration. Install equipment between 48 inches and 60 inches above the floor or permanent work platform. Equipment shall be mounted to avoid shock or vibration that may impair operation. Equipment shall be mounted for unobstructed access and walkways. Equipment support systems shall not be attached to handrails, process piping or mechanical equipment.

Instruments and cabinets supported by concrete walls shall be spaced 5/8 inch by framing channel between instrument or cabinet and wall. Block wall shall have additional installation supports, as required, to avoid damage to the wall. Equipment supports shall be hot-dip galvanized after fabrication or shall be 316L stainless steel, as shown or specified.

Support systems including panels shall be designed in accordance with Section 01900 to prevent deformation greater than 1/8 inch in any direction under the attached equipment load and under an external load of 200 pounds.

In wet or outdoor areas, conduit penetrations into instrument housing shall be made through the bottom (preferred) or side of enclosures to minimize water entry from around or from inside of conduits. Provide conduit hubs for connections and waterproof mastic for moisture sealant.

Nameplates shall be provided for all field mounted equipment. Nameplates shall be attached to support hardware with a minimum of two self-tapping Type 316 stainless steel screws in a readily visible location, but such that if the field device is changed out, the nameplate will remain to identify the service.

C. ELECTRICAL POWER CONNECTIONS:

Equipment electric power wiring shall comply with Division 16. Power disconnect switches shall be provided within sight of equipment and labeled to indicate the specific equipment served and the power source location. "Within sight of" is defined as having an unobstructed view from the equipment served and within 50 feet of the equipment served.

Equipment power disconnect switches shall be mounted between 36 inches and 72 inches above the floor or permanent work platform. Where equipment location requirements cannot be met by a single disconnect switch, provide two disconnect switches: one at the equipment and one at the work platform.

Provide a surge arrestor on each 120 volt AC disconnect switch serving equipment located outdoors. Surge arrestor shall be Telematic, LP Series or equal.

D. SIGNAL CONNECTIONS:

Equipment electric signal connections shall be made on terminal blocks or by locking plug and receptacle assemblies. Flexible cable, receptacle and plug assemblies shall be used where shown or specified.

Jacketed flexible conduit shall be used between equipment and rigid raceway systems. Flexible cable assemblies may be used where plug and receptacle assemblies are provided and the installation is not subject to mechanical damage in normal use. The length of flexible conduit or cord assemblies shall not exceed 2 feet.except where sufficient length is required to allow withdrawal of instruments for maintenance or calibration without disconnection of conduit or cord assemblies.

3.02 FIELD TESTS AND INSPECTIONS

A. DELIVERY INSPECTION:

The Contractor shall notify the Owner's Representative upon arrival of any material or equipment to be incorporated into the work. The Contractor shall remove protective covers or otherwise provide access in order that the Owner's Representative may inspect such items.

B. INSPECTION AND INSTALLED TESTS:

Refer to Section 17030 – Process Instrumentation and Control System Testing.

C. CLEANING:

1. Execute final cleaning prior to final project assessment.

2. Clean surfaces exposed to view, remove temporary labels, stains, and foreign substances.

3. Replace filters of operating equipment.

4. Remove waste and surplus materials, rubbish, and construction facilities from site.

END OF SECTION

SECTION 17030 PROCESS INSTRUMENTATION AND CONTROL SYSTEM TESTING

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies Contractor performance in testing and documentation of process instrumentation and control system materials and equipment (PICS).

The term instrumentation covers field and panel instruments, analyzers, primary sensing elements, transmitters, power supplies, and monitoring devices.

Provide the labor, tools, material, power, and services necessary to provide the process instrumentation and control system inspection and testing specified herein. Coordinate all testing with Section 01660:

A. Factory Acceptance Testing (FAT): Not Required

B. Pre-Operational Performance Testing Sequence:

1. Wiring Testing
2. Network and Bus Cable System Inspection and Testing
3. Piping Testing
4. Installation Inspection
5. Instrumentation Calibration
6. Loop Testing

C. Functional Testing Sequence:

1. Process Control Strategy Testing: Not used
2. Control System Closed Loop Commissioning: Not used
3. Functional Checkout

D. Operational Testing:

1. System Acceptance Testing (SAT)

1.02 QUALITY ASSURANCE

A. PICS TESTING MANAGER: Not Required

B. REFERENCES:

This section contains references to the following documents with additional references listed in Section 17000.
All references shall be to the current edition of the document unless specifically stated otherwise. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the

Agreement if there were no bids). If referenced documents have been discontinued by the issuing organization, reference to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ISA RP7.1	Pneumatic Control Circuit Pressure Test
ISA S51.1	Process Instrumentation Terminology

D. PROJECT LABELING

The items specifying project labeling herein shall include the following as a minimum: Owner's name, facility name, project name, and project number.

1.03 SUBMITTALS

Submittal material, to be submitted in accordance with Section 01300, shall consist of the following:

A. QUALIFICATION SUBMITTAL:

Provide the following submittal in accordance with Section 01300-Submittals:

1. Example test forms per paragraph 17030-3.01 D, revised to show Project Labeling per paragraph 17030-1.02 D.
2. Example I/O interface summary per paragraph 17030-2.02 D.: Not used

B. NETWORK TESTING QUALIFICATION SUBMITTAL:

1. Qualifications of independent industrial network testing firm and staff performing the inspection and testing.

C. DEFINITION SUBMITTAL:

Provide the following submittal after review of the Qualification Submittal. Separate submittals may be provided for each process area:

1. Testing status spreadsheets per paragraph 17030-3.01 D.
2. Test procedures per paragraph 17030-3.01 D.
3. Proposed test forms per PART 3 of this Section 17030, detailed for each test for this project.
4. Certified Factory Calibration Reports.
5. Provide a copy of this specification and the referenced and applicable sections with addenda updates included with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

6. Provide a copy of Section 17200 Instrument Index with Addenda updates included, marked to indicate requested deviations from specified requirements.
7. Provide a copy of all referenced and applicable Instrumentation Drawings with addenda updates included, marked to indicate requested deviations from specified requirements.
8. Provide a copy of all referenced and applicable Electrical Drawing's Control Diagrams with addenda updates included, marked to indicate requested deviations from specified requirements.
9. Failure to include a copy of the specifications and drawings with the submittal shall be cause for rejection of the entire submittal with no further consideration.

PART 2 PRODUCTS

2.01 TESTING DOCUMENTATION

A. CONTROL DESCRIPTION: Not Used

B. I/O INTERFACE SUMMARY: Not Used

C. INSTRUMENT INDEX

Provide a detailed Instrument Index. The Instrument Index from Section 17200 may be used as a basis. Provide details on calibration ranges, setpoints, and deadbands.

2.02 PRODUCT DATA

Provide the following product data submittal after completion of testing.

The following information shall be provided in accordance with specification Section 01300:

1. Completed test forms per PART 3. Separate submittals may be provided for each process area.

PART 3 EXECUTION

3.01 GENERAL

A. GENERAL REQUIREMENTS:

Materials, equipment, and construction included under this specification shall be inspected in accordance with this section and subsequent sections of this division. Testing shall be performed by the Contractor in accordance with this and subsequent sections of this division.

No required test shall be applied without prior notice to the Construction Manager. Between 60 and 70 days before the commencement of any testing activity, the Contractor shall provide a detailed step-by-step test procedure complete with forms for the recording of test results, testing equipment used, and a place for identification of the individual performing or, if applicable, witnessing the test.

Provide detail assistance to the Contractor in generating form 01660-A, customized for this project. Submit detailed form prior to testing per the requirements of Section 01660.

B. TECHNICIAN QUALIFICATIONS:

Field instruments and analyzers shall be calibrated and set up by a certified instrument technician qualified to calibrate the instrumentation.

Technicians shall be qualified by completion and certification from training courses offered by The Instrumentation, Systems, and Automation Society (ISA), the instrumentation and analyzer manufacturer's training courses, or technician training courses at a recognized trade school that specializes in instrumentation calibration.

C. TEST EQUIPMENT AND MATERIALS:

Provide test equipment to conduct the specified tests that simulate inputs and read outputs with a rated accuracy at the point of measurement at least three times greater than the component under test.

Test instruments shall have a current calibration sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required. Certified calibration reports traceable to the National Institute of Standards and Technology shall be included with the final test report.

Provide a documenting calibration system to conduct process instrumentation calibration activities that consist of a documenting process calibrator and an instrumentation data management software system that captures the calibration results and electronically document instrument data, date of calibration, calibration procedures, and as-found and as-left instrument calibration data.

Calibration files shall be submitted with the final test report in hard copy and electronic formats that does not require specialized equipment or software to read and print the files.

Provide a communications and software package to record final configuration parameters and settings for variable frequency drives with the parameters acquired by connection to the network that record the configuration settings without manual data entry or transcription of values.

Vendor software tools may document the systems where a licensed copy of the identical software including connectors, cables, keys, interface cards and devices required for operation is submitted with the final documentation files.

D. FIELD TEST PROCEDURE DOCUMENTATION:

Test procedures submitted for approval between 60 and 70 days before the commencement of testing activity, complete with forms for the recording of test results, testing equipment used, and a place for identification of the individuals performing and witnessing the test.

Test procedures for each analog and discrete loop in the process control system shall be organized and assembled in separate volumes for each process area. Final test records shall be submitted in electronic form by scanning and converting the records and files to Adobe PDF format, to preserve actual signatures and signoffs.

Test procedure documentation shall include a detailed, step-by-step description of the required test procedure, panel and terminal block numbers for points of measurement, input

test values, expected resultant values, test equipment required, process setup requirements, and safety precautions.

Test report forms for each loop, including forms for wiring, piping, and individual component tests, shall be included with the test procedure documentation. The actual test results shall be recorded on these forms and a final test report assembled as specified in paragraph 17030-3.05.

Test report forms shall be preprinted and completed to the extent possible prior to commencing testing. Test report forms that document the field test procedures shall include the following information:

1. Project name
2. Instrument loop description.
3. Instrument loop identification number.
4. Instrument nameplate data.
5. Instrument setup and configuration parameters.
6. Time and date of test.
7. Inspection checklist and results.
8. Reference to applicable test procedure.
9. Expected and actual test results for each test point in the loop including programmable controller data table or register values.
30. Test equipment used.
11. Space for remarks regarding test procedure or results, unusual or noteworthy observations, etc.
12. Name, date, and signature of testing personnel.

E. PERFORMANCE DEVIATION TOLERANCES:

Tolerances shall be specified in Division 17. Where tolerances are not specified, refer to the manufacturer's published performance specifications.

Overall accuracy requirements for loops consisting of two or more components shall be the root-summation-square (RSS) of the component accuracy specifications. Tolerances for each required calibration point shall be calculated and recorded on the associated test report form.

F. INSTALLED TESTS:

The Contractor’s Quality Assurance Manager shall coordinate, manage, and supervise the quality assurance program that includes:

1. Testing plan with the sequence for the test work.
2. Calibration program for all instruments and analyzers.
3. Documentation program that records tests results.
4. Performance testing program systems.

Test forms provided shall conform to the requirements of reference forms 17000-A through 17000-K included in Section 01999. Additional or detailed forms shall be developed as necessary to suit complex instrumentation. Usage of terms used on test forms shall comply with ISA S51.1.

G. WITNESSING:

The Engineer reserves the right to observe field instrumentation testing and calibration procedures. The Engineer shall be notified prior to testing, as specified herein.

3.02 FACTORY TEST

A. FACTORY ACCEPTANCE TEST (FAT): NOT REQUIRED

3.03 PRE-OPERATIONAL PERFORMANCE TESTING

A. GENERAL REQUIREMENTS:

In general, tests shall be performed in the following order:

B. WIRING TESTS:

Electrical power and signal cable ring-out and resistance testing. Conducted in accordance with Sections 16000 and 16030. Wiring tests shall not be conducted until cables have been properly terminated, tagged and inspected.

1. Power and Control: Per Section 16030.
2. Signal: Test form 17000-A.

C. NETWORK AND BUS CABLE INSPECTION AND TESTING:

Inspected and tested by independent industrial network testing firms.

Proprietary bus systems may be tested by the manufacturer's qualified field services technician. Manufacturer's sales personnel are not considered to be qualified technicians unless qualifications are documented and certified by the manufacturer.

Standardized networks and buses may be tested by a qualified independent network testing service. The following types of cabling and networks shall be tested and certified by the independent industrial network testing firm:

1. Antenna Coax cabling

2. Other networks provided as a part of a packaged monitoring or control system.

   PRE-ACTIVE TESTING: Prior to energizing, cabling shall be inspected and tested to verify the following:

   a. Media type and specifications.
   b. Physical routing and project specific cable identification tagging.
   c. Correct termination installation and connection of conductors to pins at terminations.
   d. Record cable run length and compare to the manufacturer or industry standards to verify lengths are within specifications.
   e. Locations and values of network termination resistance.
   f. Integrity and grounding of cable shields.
   g. Values of transient protection (surge) elements.

ACTIVE SYSTEM TESTING: After the cable or network system has been activated for testing, provide diagnostic monitoring and signal analysis for the bus network system to evaluate network and bus integrity and data transfer quality. The following parameters shall be measured, verified, and recorded:

a. Node addressing.
b. Signal attenuation before and after any repeater device and at the farthest point in the network.
c. Total network trunk voltage and current loading as applicable.
d. Baud rate, message traffic rate, percent bandwidth used, error rate, lost packet count.
e. Pre-active and active testing shall fall within the specified range of values established by the referenced standards.
f. Correct the functionality of networks and devices connected to the network.

D. PIPING TESTS:

1. Pneumatic Piping Systems: Pneumatic piping systems shall be tested for leaks in compliance with ISA RP7.1, except performed at ten times the normal system operating pressure. Test form 17000-B.
2. Liquid Piping Systems: Tested for leaks in compliance with Section 15050.

E. INSTRUMENT AND COMPONENT INSPECTION:

1. Compare and validate instrument type and nameplate data with the drawings, specifications, and data sheet.
2. Validate instrument identification tag.
3. Confirm instrument installation conforms to drawings, specifications, and manufacturer’s instructions.
4. Verify proper conductor termination and tagging.
5. Visual check for physical damage, dirt accumulation, and corrosion.
6. Verify including isolation amplifiers, surge protection, and safety barriers are properly installed.
7. Report deficiencies identified within 24 hours of discovery. No instrument or system component shall be tested until all deficiencies are addressed.

F. INSTRUMENTATION CALIBRATION:

1. Instruments and final elements shall be field calibrated in accordance with the manufacturer's recommended procedures and tested in accordance with the Contractor's test procedure.
2. Individual Component Calibration and Testing shall not commence until Instruments and Component Inspections are completed and documented to the satisfaction of the Engineer.
3. Analog instrument calibrated at 0, 10, 50, 90, and 100 percent of the specified full-scale range. Each signal sensing trip and process sensing switch shall be adjusted to the required setting. Test data recorded on test forms as specified herein.
4. Final element alignment tested and adjusted to verify that each final element operates smoothly over the full range in response to the specified process control signals.

5. Test data shall be entered on the applicable test forms at the time of testing: Alarm trips, control trips, and switches shall be set to initial values specified in Section 17200 Instrument Index at this time. Final elements shall be checked for range, dead-band, and speed of response.
6. Any component that fails to meet the required tolerances shall be repaired or replaced by the manufacturer. Repeat the specified tests until the component is within tolerance.
7. Install a calibration sticker on each instrument following successful calibration that indicates the date of calibration, the name of the testing company, and personnel who calibrated the instrument.
8. Test forms 17000-C through 17000-I.
9. CERTIFIED TEST REPORTS: Field test and inspection activities include verification of instrument parameter setup, verification of instrument zero, and performance at three operating points within the instrument range. Instrument which fails to demonstrate proper performance shall be returned for re-calibration or replaced as agreed depending on the impact to the project as determined by the Construction Manager.

   Where instrument field calibration is not feasible, certified factory calibration reports may be submitted that includes the name and address of the laboratory that conducts the calibration testing. Certified factory test reports may be submitted for the following instrument types in lieu of field calibration:

F. LOOP TESTING:

1. Loop Testing shall not commence until the Individual Component Calibration and Testing has been completed and documented to the satisfaction of the Engineer.
2. Each instrument loop shall be tested as an integrated system. Check operation from field instruments to transmitter to receiving components to the vendor panel or the Plant Control System Operator Interface Station. Test signals shall be injected at the process impulse line connection where the measuring technique permits, and otherwise at the most primary signal access point.
3. Testing of loops with an interface to a programmable logic controller shall include verification of the programmable logic controller input/output assignment and verification of operation of the input/output system and processor. Inspect the data table or register in the programmable logic controller memory to verify proper operation.
4. If the output control or monitoring device fails to indicate properly, corrections to the loop circuitry or device shall be made. The test shall be repeated until devices and instruments operate as required.
5. Correct loop circuitry and repeat the test until the instruments operate properly.

3.04 FUNCTIONAL TESTING

A. PROCESS CONTROL STRATEGY/FUNCTIONAL TESTING: NOT USED

B. CONTROL SYSTEM CLOSED LOOP TESTING: Not Used

C. FUNCTIONAL CHECKOUT:

Conducted to verify the operation of discrete and hardwired control devices. Exercise the operable devices and energizing the control circuit. Operate control element, alarm device, and interlocks to verify the specified action occurs.

3.05 OPERATIONAL TESTING

System Acceptance Test (SAT) shall be performed after component and subsystem tests have been completed. The test of the completed system shall be performed in full operation and shall demonstrate that all functional requirements of this specification have been met. SAT shall demonstrate the following:

1. Each component of the system operates correctly with all other components of the system.
2. Analog control loops operate in a stable manner.
3. Hard-wired and software equipment interlocks perform correctly.
4. Process control sequences perform correctly.
5. RTU application program performs monitoring and control functions correctly.

END OF SECTION

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SECTION 17200 INSTRUMENT INDEX

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies the Instrument Index and general requirements applicable to process instrumentation and analyzer systems consisting of process sensors, process indicators, signal conditioning module, control and monitoring devices, transmitters, and accessories.

The Contractor shall provide, calibrate, and test the complete process instrumentation and analyzer systems and place in operation and test the system. Testing includes tuning loops and making final adjustments to instruments and analyzers during facility start-up.

The Contactor shall provide the services of certified instrument technicians for testing and adjustment activities as specified in Section 17000.

The Contractor shall examine the mechanical drawings and specifications to determine actual locations, sizes, materials and ratings of process connections. Process taps shall be indicated on pipe shop drawings as specified in paragraph 15050-2.04.

1.02 REFERENCES

Refer to Section 17000 – General Requirements for Instrumentation and Control.

Refer to Section 17030 – Process Instrumentation and Control System Testing.

1.03 SUBMITTALS

Refer to Sections 17000 and 17030.

PART 2 PRODUCTS

2.01 INSTRUMENT INDEX

The Instrument Index, paragraph 17200-3.03, lists instruments and analyzers required for the project. Instrument functions specified on this list shall be provided by the Contractor.

Additional instrumentation devices such as process taps, seals, and other items required to complete the instrument loops due to characteristics of the equipment selected by the Contractor and not specified in the instrument index or on the contract drawings shall be provided at no additional cost to provide a complete working system.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

Materials, equipment, and installation shall be tested and inspected per Sections 17000, 17030, and this section.

Provide buffer solutions and reference fluids for analytical equipment test procedures.

3.02 INSTALLED EQUIPMENT - TESTS AND INSPECTION

A. Refer to Section 17030 – Process Instrumentation and Control System Testing.

3.03 INSTRUMENT INDEX

The following is an index of the instrumentation equipment, analyzers, and devices.

A. DESCRIPTION OF HEADINGS:

1. TAG NUMBER:
   Tag Number appears as a heading (PREFIX and NUMBER) and consists of a two, three- or four-letter prefix indicating the instrument function followed by a number identifying the process loop with which the instrument is associated. Tag Number provides an identification of the instrument, analyzer, or device.

2. DESCRIPTION:
   Provides the functional description of the instrument, analyzer, or device.

3. P&ID NUMBER:
   Lists the Process and Instrumentation Diagram on which the instrument, analyzer, or device appears.

4. SPECIFICATION:
   Provides the specification reference and “INSTRUSPEC” designation for the instrument, analyzer, or device.

5. RANGE:
   Provides the calibrated instrument range for each application.

6. SETPOINT:
   Provides the calibrated switch setpoint.

7. COMMENTS:
   Provides the features, interlocks, and information applicable to the instrument, analyzer, or device.

TAG NO.	DESCRIPTION	P&ID	SPEC	RANGE	SETPOINT	COMMENTS
NR09-FE/FIT-200	L.S. FLOW	I-10-601	17212/FM	0-6000 GPM	N/A	16” PIPE DIAMETER

END OF SECTION

SECTION 17212 TRANSMITTERS

PART 1 GENERAL

1.01 DESCRIPTION

This section specifies requirements for process parameter transmitters, associated indication devices, and accessories.

The application requirements are specified in the Instrument Index - Section 17200.

1.02 REFERENCES

References shall be as specified in Section 17000.

1.03 SUBMITTALS

Submittals shall be provided as specified in Sections 01300 and 17000, including:

1. A copy of this 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. Referenced and applicable sections to be marked up and submitted include:

   a. Section 01664 - TRAINING
   b. Section 01730 – OPERATING AND MAINTENANCE INFORMATION
   c. Section 17000 - GENERAL REQUIREMENTS FOR INSTRUMENTATION AND CONTROL
   d. Section 17200 – INSTRUMENT INDEX

   A check mark 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, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. A copy of the contract document Control Diagrams and Process and Instrumentation Diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required"*. *Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

3. Marked Contract Document Mechanical and/or Electrical Plan drawings, sections, and details showing sensor installation locations and details. *Failure to include*

copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

4. Marked product literature of all equipment and features to be provided.

5. Installation drawings for only the transmitters, sensors, and mounting accessories to be provided.

6. Electrical and signal connection drawings for only the transmitters and sensors to be provided.

7. List of miscellaneous items, cables, spare parts, that will be provided in accordance with INSTRUSPEC sheet requirements.

8. Marked product literature for surge protectors.

PART 2 PRODUCTS

2.01 GENERAL

Measuring elements and transmitters shall comply with the following requirements:

1. Measured parameter output indicators complying with paragraph 17212-2.02 shall be provided with any transmitter that does not include an integral indicator. Indicators, whether integral or separate, shall be calibrated in process units, and engraved on the indicator scale plate.

2. The two-wire type transmitters shall have operating power derived from the signal transmission circuit.

3. Transmitters shall meet specified performance requirements with load variations within the range of 0 to 600 with the power supply at a nominal 24 volts DC with the default range of 0 to 100% corresponding to 4 to 20 madc.

4. Transmitter output shall increase with increasing measurement.

5. Time constant shall be adjustable from 0.5 to 5.0 seconds for transmitters used for flow, level transmitters used for flow measurement, or pressure measurement.

6. Transmitter output shall be galvanically isolated via electro-mechanical or optical technology.

7. Transmitter enclosures shall be rated NEMA 250, Type 4, unless otherwise specified.

8. Transmitters located outdoors shall be provided with surge protectors:

   a. Signal: Emerson/Rosemount Model 470 D, Emerson/EDCO SS64-036-2, CCI SPN-42 FS28 Series, or accepted equal.

   b. AC Power: UL 1449, LED indicator, screw terminal connections, NEMA 4X. EDCO HSP121A or accepted equal.

9. Two-wire transmitter located in a facility area classified as hazardous per the NFPA and the NEC shall be made safe by means of an intrinsic safety barrier as specified in paragraph 17212-2.03.

10. Four-wire transmitters shall be isolated from the process and power or provided with a loop-powered signal current isolator as specified in paragraph 17212-2.05 connected in the output signal circuit.

2.02 PROCESS PARAMETER OUTPUT INDICATOR

Provide digital LED or LCD indicators that integral to the instrument housing where available from the manufacturer. Displays shall be scaled in engineering units, over the calibrated range of the instrument. Calibrate the indicator scale in process units.

Analog output indicators shall be 2.5-inch milli-ammeter with 90-degree movement enclosed in a NEMA 7/9 rated meter case. Provide indicators with accuracy within two percent of span. Provide a diode to maintain loop continuity for indicator removal.

2.03 INTRINSIC SAFETY BARRIERS

Intrinsic safety barriers for two-wire transmitters shall be of the active, isolating, loop powered type. Barrier shall be Stahl Series 9000, Accepted equal.

2.04 INSTRUMENTATION SPECIFICATION SHEETS (INSTRUSPEC)

General requirements for instruments specified in this section are listed on INSTRUSPEC sheets in paragraph 17212-3.03.

Application requirements are specified in the Instrument Index, paragraph 17200-2.03, and/or on the drawings.

2.05 SIGNAL CURRENT ISOLATOR

Isolator shall provide galvanic isolation of milliampere transmission signals from transmitters. Isolator shall be housed in a NEMA 250, Type 4/7 conduit body and derive operating power from the signal input circuit.

Input and output signals shall be 4 to 20 milliamperes, and error shall not exceed 0.1 percent of span. Input resistance shall not exceed 550 ohms with an output load of 250 ohms.

Isolator shall be Moore Industries SCX 4-20madc to 4-20madc / 5.5VPL / -RF DIN rail mounted with maximum 250-ohm output impedance, Phoenix Contact, or equal.

2.06 PRODUCT DATA

The following data provided in accordance with Section 01300:

1. Operating and maintenance information as specified in paragraph 17000-2.03. Include final reviewed submittal and separate record of all final configuration, jumper, and switch settings for each transmitter.

2. Test results as specified in Section 17030-Part 2.

PART 3 EXECUTION

3.01 INSTALLATION

Installation requirements are specified in paragraph 17000-3.01.

A. Process Connections:

1. General:

a. Process connections shall be arranged such that instruments may be readily removed for maintenance without disruption of process units or draining of large tanks or vessels. Unions or flange connections shall be provided as necessary to permit removal without rotating equipment.

1) Where process taps are not readily accessible from instrument locations, an isolation valve shall be provided at the instrument.

2) Isolation valves shall be provided for each instrument where multiple instruments are connected to one process tap.

3) Pipe between the process connection and instruments shall be 1/2-inch stainless steel with treatment material for easy removal, as specified herein.

2. Safety Instruments:

a. No valves shall be installed at pressure taps for safety instruments. Safety instruments shall not be connected to the same process tap as instruments used for control, indication, or recording except when annular chemical seals are used.

3. Root Valves:

a. Root valves shall be provided at all process taps, except as follows:

1) Temperature taps, where valves are unnecessary.

2) Pump discharge pressure taps where no instrument is permanently

3) installed. Isolation valves shall be provided.

4) Process taps for safety instruments.

5) Where gauge valves are provided.

6) Where chemical seals are used.

4. Gauge Valves:

a. Gauge valves shall be provided for each pressure gauge tap except where chemical seals are used.

B. Tubing:

1. Tubing shall be installed on supports spaced not more than 3 feet apart and shall run parallel of perpendicular to walls structural members, or intersections of vertical planes and the ceiling. Unless otherwise shown, tubing shall follow building surfaces closely or shall be carried in trays or conduit.

2. Tubing shall not be supported from piping or equipment except at process taps or connections to the device served. Tubes supported directly on concrete surfaces shall be spaced at least 1/8 inch from the concrete. Tubing support shall be one-hole malleable iron clamps with clamp backs as required. Bends shall be formed to uniform radii without flattening.

3. Ends of tubing shall be square-cut and de-burred before installation in fittings. Fittings shall be used for splices, connections, and turns near final connections. Bulkhead fittings shall be used when tubing enters a panel.

C. Electrical Connections:

1. Final connections between rigid raceway systems and instruments shall be made with jacketed flexible conduit with a maximum length of 2 feet.

D. Outdoor Transmitters:

1. Transmitters mounted outdoors shall be provided with rain/sun hood on top and sides of transmitter.

3.02 TESTING

Testing requirements are specified in Section 17030.

3.03 INSTRUMENT SPECIFICATION (INSTRUSPEC) SHEETS

General requirements for instruments specified in this section are listed on INSTRUSPEC sheets herein. Application requirements are specified in the Instrument Index, paragraph 17200-3.03, and/or on the drawings. INSTRUSPEC sheets for the transmitters listed in the following Table A are included in this paragraph:

Table A: Process Monitors and Indicating Transmitters

INSTRUSPEC Symbol	Instrument Description	Instrument Function
FM	Magnetic Flow Transmitter	Flow Measurement

3.04 INSTRUMENT SPECIFICATION SHEET--INSTRUSPEC

Instrument Identification:	FM
Instrument Function:	Flow Measurement
Instrument Description:	Magnetic Flow Metering System
Signal Input:	Process
Signal Output:	Analog signal as specified in paragraph 17212-2.01
Process Connection:	Flange, ANSI B16.5, Class 150, raised face.
Product Requirements:	Magnetic flow meter provided as a system consisting of a flow tube with separate converter / indicating transmitter, as scheduled in the Section 17200 Instrument Index, complete with interconnecting cables Remote mounted indicating transmitter for full-scale flow rates from 1.0 to 30 feet per second. System error shall not exceed the

greater of 0.5 percent of flowrate or 0.1 foot per second from 3 to 30 feet per second.

Class 1, Division 2 Hazardous Location Rating.

Flow Tube:

Flow tubes manufacturer shall provide grounding rings fabricated from the same metal as for the electrodes below.

Flow tube sizes below 2 inches may be wafer-style ductile-iron or full-body flanged construction.

Electrodes: 316L stainless steel.

Instrument Identification:

FM (continued)

Liner: UltraLiner NSF approved, fusion bonded epoxy

Transmitter:

Contain electronics associated with the magnetic flow meter system. Enclosure rating NEMA-4, cast aluminum or metal compartment for power, field connections and calibration adjustments separate from digital circuitry.

Means to calibrate the metering system without use of external calibration units. Transmitter self-diagnostics. Traceability certificate of actual flow lab certification provided with each flow tube.

Integral 4-digit LCD flow indication calibrated in process units. Data retained in non-volatile memory.

Execution:

Installation:

Install in accordance with manufacturer's instructions and the specified functional requirements.

Cable:

Signal cable between the flow tube and transmitter provided by the system manufacturer with sufficient length of cable for continuous installation between the flow tube and the transmitter.

Manufacturers:

McCrometer Ultra Mag UM06

Accepted equal.

END OF SECTION

BID ATTACHMENT 3, PLAN SET / DRAWINGS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

SECTION D, SAMPLE CONSTRUCTION AGREEMENT WITH GENERAL CONDITIONS OF THE CONSTRUCTION AGREEMENT AND AGREEMENT EXHIBITS

CONSTRUCTION AGREEMENT

for

STIPULATED SUM

between

MANATEE COUNTY (AS OWNER)

and

_____ (AS CONTRACTOR)

AGREEMENT NO.

CONSTRUCTION AGREEMENT FOR
STIPULATED SUM
[PROJECT NAME]

THIS AGREEMENT ("Agreement") is made and entered into by and between Manatee County, a political subdivision of the State of Florida, referred to herein as "Owner", and the firm of _____, incorporated in the State of _____ and registered and licensed to do business in the State of Florida (license #_____), referred to herein as "Contractor."

WHEREAS, the Owner intends to construct **[PROJECT DESCRIPTION]**, the aforementioned improvements being hereinafter referred to and defined as the "Project"; and

WHEREAS, in response to Owner's Invitation for Bid Construction No. _____ (the "IFBC"), Contractor has submitted its Bid (the "Contractor's Bid") to provide the aforementioned construction services.

NOW THEREFORE, the Owner and the Contractor, in consideration of the mutual covenants hereinafter set forth, the sufficiency of which is hereby acknowledged, agree as follows:

1. Contract Documents. The Contract Documents consist of this Agreement and attached Exhibits, the attached General Conditions of the Construction Agreement, Supplementary Conditions (if any), Special Conditions (if any), Drawings (the titles of which are attached hereto as Exhibit A), Specifications (the titles of which are attached hereto as Exhibit B), Addenda issued prior to execution of this Agreement, the Invitation for Bid (including any Instructions to Bidders, Scope of Work, Bid Summary, Supplements, and Technical Specifications), any interpretations issued pursuant to the Invitation for Bid, the Contractor's Bid, permits, notice of intent to award, Notice to Proceed, purchase order(s), any other documents listed in this Agreement, and Modifications [to include written Amendment(s), Change Order(s), Work Directive Change(s) and Field Directive(s)] issued after execution of this Agreement. These form the Agreement, and are as fully a part of the Agreement as if attached or repeated herein. This Agreement represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. No other documents shall be considered Contract Documents.

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

3. Date of Commencement and Substantial Completion.

A. Date of Commencement. The date of commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner.

B. Contract Time. The Contract Time shall be measured from the date of commencement.

C. Substantial Completion. The Contractor shall achieve Substantial Completion of the entire Work not later than ___ days from the date of commencement, or as follows:

Portion of Work	Substantial Completion Date

subject to adjustments of this Contract Time as provided in the Contract Documents.

Time is of the essence in the Contract Documents and all obligations thereunder. If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents (to include not only the entire Work but any portion of the Work as set forth above), the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of $_____ per calendar day, commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable estimate of damages the Owner will incur because of delayed completion of the Work. The Owner may deduct liquidated damages as described in this paragraph from any unpaid amounts then or thereafter due the Contractor under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at the maximum allowable rate.

4. Contract Sum.

A. Payment. The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be _____ Dollars and Zero Cents ($_____), subject to additions and deductions as provided in the Contract Documents.

B. Alternates. The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner. *(State the numbers or other identification of accepted alternates. If decisions on other alternates are to be made by the Owner subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)*

C. Unit Prices. Unit prices, if any, are reflected in the Contractor's Bid.

5. Payments.

A. Progress Payments.

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

(2) The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

(3) Payments shall be made by Owner in accordance with the requirements of Section 218.735, Florida Statutes.

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

(5) Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

(6) Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

i. Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of five percent (5.00%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 3.3.B. of the General Conditions;

ii. Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), supported by paid receipts, less retainage of five percent (5.00%);

iii. Subtract the aggregate of previous payments made by the Owner; and

iv. Subtract amounts, if any, for which the Architect/Engineer has withheld or nullified an Application for Payment, in whole or in part as provided in Section 3.3.C. of the General Conditions.

(7) The progress payment amount determined in accordance with Section 5.A(6) shall be further modified under the following circumstances:

i. Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect/Engineer shall determine for

incomplete Work, retainage applicable to such work and unsettled claims.

ii. Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 3.2.B. of the General Conditions.

(8) Reduction or limitation of retainage, if any, shall be as follows:

Notwithstanding the foregoing, upon completion of at least 50% of the Work, as determined by the Architect/Engineer and Owner, the Owner may, with the concurrence of the Architect/Engineer, reduce to two and one-half percent (2.5%) the amount of retainage withheld from each subsequent progress payment.

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

B. Final Payment. Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when:

(1) The Contractor has fully performed the Work except for the Contractor's responsibility to correct Work as provided in Section 2.4.C. of the General Conditions, and to satisfy other requirements, if any, which extend beyond final payment; and

(2) A final Application for Payment has been approved by the Architect/Engineer.

6. Termination or Suspension.

A. Termination. The Agreement may be terminated by the Owner or the Contractor as provided in Article XIV of the General Conditions.

B. Suspension by Owner. The Work may be suspended by the Owner as provided in Article XIV of the General Conditions.

7. Other Provisions.

A. Substantial Completion Defined. Substantial Completion shall be defined as provided in Article I of the General Conditions. In the event a temporary certificate of occupancy or completion is issued establishing Substantial Completion, the Contractor shall diligently pursue the issuance of a permanent certificate of occupancy or completion.

B. Project Meetings. There shall be a project meeting, at the jobsite or other location acceptable to the parties, on a regularly scheduled basis. The meeting will be attended by a representative of the Contractor, Architect/Engineer and Owner. These representatives shall be authorized to make decisions that are not otherwise contrary to the requirements of this Agreement.

C. Weather. Any rainfall, temperatures below 32 degrees Fahrenheit or winds greater than 25 m.p.h. which actually prevents Work on a given day, shall be considered lost time and an additional day added to the Contract Time, provided no work could be done on site, and provided written notice has been submitted to the Owner by the Contractor documenting same.

D. Shop Drawings; Critical Submittals. In consideration of the impact of timely review of submittals and shop drawings on the overall progress of the Work, it is hereby agreed that the Owner shall cause his agents and design professionals to accomplish the review of any particular "critical" submittals and/or shop drawings and return same to the Contractor within fourteen (14) days.

E. Applications for Payment. Applications for Payment shall be submitted once monthly at regular intervals and shall include detailed documentation of all costs incurred.

F. Punch List. Within 30 days after obtainment of Substantial Completion, the Owner shall generate a "punch list" of all work items requiring remedial attention by the Contractor. Within 5 days thereafter the Architect/Engineer shall assign a fair value to the punch list items, which sum shall be deducted from the next scheduled progress payment to the Contractor. Upon satisfactory completion of the punch list items, as certified by the Architect/Engineer, the previously deducted sum shall be paid to the Contractor.

G. Closeout documentation. Within 30 days after obtainment of Substantial Completion and before final payment, Contractor shall gather and deliver to Owner all warranty documentation, all manufacturer's product and warranty literature, all manuals (including parts and technical manuals), all schematics and handbooks, and all as-built drawings.

H. Governing Provisions; Conflicts. In the event of a conflict between this Agreement and the Specifications or as between the General Conditions and the Specifications, the Specifications shall govern.

I. E-Verify. The Contractor's employment of unauthorized aliens is a violation of Section 274(e) of the Federal Immigration and Employment Act. The Contractor shall utilize the U.S. Department of Homeland Security E-Verify system to verify the employment eligibility of all new employees hired during the term of this Agreement, and shall require the same verification procedure of all Subcontractors.

8. Insurance and Bonding. If and to the extent required by the Invitation for Bid documents, the Contractor shall furnish insurance coverage for (but not necessarily limited to) workers' compensation, commercial general liability, auto liability, excess liability, and builder's risk. The Contractor shall furnish to the Owner all appropriate policies and Certificate(s) of Insurance. The Contractor shall also post a Payment and Performance Bond for the Contract Sum, within ten (10) days following notification of intent to award, and otherwise in accordance with the Invitation for Bid documents.

9. Independent Contractor. The Contractor acknowledges that it is functioning as an independent contractor in performing under the terms of this Agreement, and it is not acting as an employee of the Owner.

10. Entire Agreement. This Agreement (inclusive of the Contract Documents incorporated herein by reference) represents the full agreement of the parties.

11. Amendments; Waivers; Assignment.

A. Amendments. This Agreement may be amended only pursuant to an instrument in writing that has been jointly executed by authorized representatives of the parties hereto.

B. Waivers. Neither this Agreement nor any portion of it may be modified or waived orally. However, each party (through its governing body or properly authorized officer) shall have the right, but not the obligation, to waive, on a case-by-case basis, any right or condition herein reserved or intended for the benefit or protection of such party without being deemed or considered to have waived such right or condition for any other case, situation, or circumstance and without being deemed or considered to have waived any other right or condition. No such waiver shall be effective unless made in writing with an express and specific statement of the intent of such governing body or officer to provide such waiver.

C. Assignment. The rights and obligations of either party to this Agreement may be assigned to a third party only pursuant to a written amendment hereto.

12. Validity. Each of the Owner and Contractor represents and warrants to the other its respective authority to enter into this Agreement.

13. Covenant to Defend. Neither the validity of this Agreement nor the validity of any portion hereof may be challenged by any party hereto, and each party hereto hereby waives any right to initiate any such challenge. Furthermore, if this Agreement or any portion hereof is challenged by a third party in any judicial, administrative, or appellate proceeding (each party hereby covenanting with the other party not to initiate, encourage, foster, promote, cooperate with, or acquiesce to such challenge), the parties hereto collectively and individually agree, at their individual sole cost and expense, to defend in good faith its validity through a final judicial determination or other resolution, unless all parties mutually agree in writing not to defend such challenge or not to appeal any decision invalidating this Agreement or any portion thereof.

14. Disclaimer of Third-Party Beneficiaries; Successors and Assigns. This Agreement is solely for the benefit of the parties hereto, and no right, privilege, or cause of action shall by reason hereof accrue upon, to, or for the benefit of any third party. Nothing in this Agreement is intended or shall be construed to confer upon or give any person, corporation, partnership, trust, private entity, agency, or other governmental entity any right, privilege, remedy, or claim under or by reason of this Agreement or any provisions or conditions hereof. This Agreement shall be binding upon, and its benefits and advantages shall inure to, the successors and assigns of the parties hereto.

15. Construction.

A. Headings and Captions. The headings and captions of articles, sections, and paragraphs used in this Agreement are for convenience of reference only and are not intended to define or limit their contents, nor are they to affect the construction of or be taken into consideration in interpreting this Agreement.

B. Legal References. All references to statutory sections or chapters shall be construed to include subsequent amendments to such provisions, and to refer to the successor provision of any such provision. References to "applicable law" and "general law" shall be construed to include provisions of local, state and federal law, whether established by legislative action, administrative rule or regulation, or judicial decision.

16. Severability. The provisions of this Agreement are declared by the parties hereto to be severable. In the event any term or provision of this Agreement shall be held invalid by a court of competent jurisdiction, such invalid term or provision should not affect the validity of any other term or provision hereof; and all such terms and provisions hereof shall be enforceable to the fullest extent permitted by law as if such invalid term or provision had never been part of this Agreement; provided, however, if any term or provision of this Agreement is held to be invalid due to the scope or extent thereof, then, to the extent permitted by law, such term or provision shall be automatically deemed modified in order that it may be enforced to the maximum scope and extent permitted by law.

17. Governing Law; Venue. This Agreement shall be governed by the laws of the State of Florida. Venue for any petition for writ of certiorari or other court action allowed by this Agreement shall be in the Circuit Court of the Twelfth Judicial Circuit in and for Manatee County, Florida.

18. Attorney's Fees and Costs. In any claim dispute procedure or litigation arising from this Agreement, each party hereto shall be solely responsible for paying its attorney's fees and costs.

19. Notices. All notices, comments, consents, objections, approvals, waivers, and elections under this Agreement shall be in writing and shall be given only by hand delivery for which a receipt is obtained, or certified mail, prepaid with confirmation of delivery requested, or by electronic mail with delivery confirmation. All such communications shall be addressed to the applicable addressees set forth below or as any party may otherwise designate in the manner prescribed herein.

To the Owner: _____
_____
_____
_____
Email: _____

To the Contractor:
_____
_____
_____
_____
Email: _____

Notices, comments, consents, objections, approvals, waivers, and elections shall be deemed given when received by the party for whom such communication is intended at such party's address herein specified, or such other physical address or email address as such party may have substituted by notice to the other.

20. Public Records Law. The Contractor shall comply with the Florida Public Records Act (Chapter 119, Florida Statutes), and shall:

A. Keep and maintain public records required by the Owner to perform the services called for in this Agreement.
B. Upon request from the Owner's custodian of public records, provide the Owner 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 in Chapter 119, Florida Statutes or as otherwise provided by law.
C. 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 this Agreement and following completion of this Agreement if the Contractor does not transfer the records to the Owner.
D. Upon completion of this Agreement, transfer, at no cost, to the Owner all public records in possession of the Contractor or keep and maintain such public records. If the Contractor transfers all public records to the Owner upon completion of the Agreement, 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 Agreement, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the Owner, upon request from the Owner's custodian of public records, in a format that is compatible with the information technology systems of the Owner.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE OWNER'S CUSTODIAN OF PUBLIC RECORDS AT 941-748-4501, EXT. 5845; DEBBIE.SCACCIANOCE@MYMANATEE.ORG; POST OFFICE BOX 1000, BRADENTON, FLORIDA 34206.

21. Exhibits. Exhibits to this Agreement are as follows:

Exhibit A—Title(s) of Drawings

Exhibit B—Title(s) of Specifications

Exhibit C—Affidavit of No Conflict

Exhibit D—Certificate(s) of Insurance

Exhibit E—Payment and Performance Bond

Exhibit F—Standard Forms

1—Application for Payment
2—Certificate of Substantial Completion
3—Final Reconciliation / Warranty / Affidavit
4—Change Order

(*Remainder of this page intentionally left blank*)

WHEREFORE, the parties hereto have executed this Agreement as of the date last executed below.

_____
Name of Contractor

By: _____

Printed Name: _____

Title: _____

Date: _____

MANATEE COUNTY, a political subdivision of the State of Florida

By: _____

Printed Name: _____

Title: _____

Date: _____

GENERAL CONDITIONS

of the

CONSTRUCTION AGREEMENT

TABLE OF CONTENTS FOR GENERAL CONDITIONS

GENERAL CONDITIONS
ARTICLE I
DEFINITIONS

1.1 Definitions. For purposes of the Contract Documents, the following terms shall have the following meanings.

A. Acceptance: The acceptance of the Project into the Owner's operating public infrastructure.

B. Application for Payment: The form approved and accepted by the Owner, which is to be used by Contractor in requesting progress payments or final payment and which is to include such supporting documentation as is required by the Contract Documents.

C. Architect/Engineer: _____, a _____ corporation or limited liability company, registered and licensed to do business in the State of Florida, OR _____, an employee of Owner.

D. Change Order: A written order signed by the Owner, the Architect/Engineer and the Contractor authorizing a change in the Project Plans and/or Specifications and, if necessary, a corresponding adjustment in the Contract Sum and/or Contract Time, pursuant to Article V.

E. Construction Services: The Construction Services to be provided by Contractor pursuant to Section 2.4, in accordance with the terms and provisions of the Contract Documents.

F. Construction Team: The working team established pursuant to Section 2.1.B.

G. Contract Sum: The total compensation to be paid to the Contractor for Construction Services rendered pursuant to the Contract Documents, as set forth in Contractor's Bid (or Guaranteed Maximum Price Addendum), unless adjusted in accordance with the terms of the Contract Documents

H. Contract Time: The time period during which all Construction Services are to be completed pursuant to the Contract Documents, to be set forth in the Project Schedule.

I. Contractor's Personnel: The Contractor's key personnel designated by Contractor.

J. Days: Calendar days except when specified differently. When 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 legal holiday, such day will be omitted from the computation.

K. Defective: When modifying the term "Work", referring to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or that does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or that has been damaged prior to Owner's approval of final payment (unless responsibility for the protection thereof has been assumed by Owner).

L. Field Directive: A written order issued by Owner which orders minor changes in the Work not involving a change in Contract Time, to be paid from the Owner's contingency funds.

M. Final Completion Date: The date upon which the Project is fully constructed and all Work required on the Project and Project Site is fully performed as verified in writing by the Owner.

N. Float Time: The time available in the Project Schedule during which an unexpected activity can be completed without delaying Substantial Completion of the Work.

O. Force Majeure: Those conditions constituting excuse from performance as described in and subject to the conditions described in Article XII.

P. Notice to Proceed: Written notice by Owner (after execution of Contract) to Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform the Work.

Q. Owner: Manatee County, a political subdivision of the State of Florida.

R. Owner's Project Representative: The individual designated by Owner to perform those functions set forth in Section 7.8.

S. Payment and Performance Bond: The Payment and Performance Bond security posted pursuant to Section 2.4.Y to guarantee payment and performance by the Contractor of its obligations hereunder.

T. Permitting Authority: Any applicable governmental authority acting in its governmental and regulatory capacity which is required to issue or grant any permit, certificate, license or other approval which is required as a condition precedent to the commencement or approved of the Work, or any part thereof, including the building permit.

U. Procurement Ordinance: The Manatee County Procurement Code, Chapter 2-26 of the Manatee County Code of Laws, as amended from time to time.

V. Progress Report: A report to Owner that includes all information required pursuant to the Contract Documents and submitted in accordance with Section 2.4.EE, hereof.

W. Project: The total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by Owner and by separate contractors. For the purposes of the Contract Documents, the term Project shall

include all areas of proposed improvements and all areas which may reasonably be judged to have an impact on the Project.

X. Project Costs: The costs incurred by the Contractor to plan, construct and equip the Project and included within, and paid as a component of, the Contract Sum.

Y. Project Manager: Subject to the prior written consent of Owner, the individual designated to receive notices on behalf of the Contractor, or such other individual designated by the Contractor, from time to time, pursuant to written notice in accordance with the Contract Documents.

Z. Project Plans and Specifications: The one hundred percent (100%) construction drawings and specifications prepared by the Architect/Engineer, and any changes, supplements, amendments or additions thereto approved by the Owner, which shall also include any construction drawings and final specifications required for the repair or construction of the Project, as provided herein.

AA. Project Schedule: The schedule and sequence of events for the commencement, progression and completion of the Project, developed pursuant to Section 2.3., as such schedule may be amended as provided herein.

BB. Project Site: The site depicted in the Project Plans and Specifications, inclusive of all rights of way, temporary construction easements or licensed or leased sovereign lands.

CC. Subcontractor: Any individual (other than a direct employee of the Contractor) or organization retained by Contractor to plan, construct or equip the Project pursuant to Article IV.

DD. Substantial Completion and Substantially Complete: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use; provided, however, that as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy or completion and other permits, approvals, licenses, and other documents from any governmental authority which are necessary for the beneficial occupancy of the Project or any designated portion thereof.

EE. Substantial Completion Date: The date on which the Project or designated portion thereof is deemed to be Substantially Complete, as evidenced by receipt of (i) the Architect/Engineer's certificate of Substantial Completion, (ii) written Acceptance of the Project by the Owner, and (iii) approvals of any other authority as may be necessary or otherwise required.

FF. Substitute: Materials or equipment offered by the Contractor as an alternative to that set forth in the Project Plans and Specifications, where (i) the Project Plans and Specifications do not authorize an "approved equal", or (ii) the Owner, in its reasonable discretion, determines that a pre-authorized "approved equal" will result in a substantial change to the Work because of cost, quality or other difference in comparison to the materials or equipment specified.

GG. Unit Price Work: Work to be paid for on the basis of unit prices.

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

II. Work Directive Change: A written directive to Contractor, issued on or after the effective date of the Agreement pursuant to Section 5.8 and signed by Owner's Project Representative, 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 or responding to emergencies.

ARTICLE II
RELATIONSHIP AND RESPONSIBILITIES

2.1 Relationship between Contractor and Owner. The Contractor accepts the relationship of trust and confidence established with Owner pursuant to the Contract Documents. The Contractor shall furnish its best skill and judgment and cooperate with Owner and Owner's Project Representative in furthering the interests of the Owner. The Contractor agrees to provide the professional services required to complete the Project consistent with the Owner's direction and the terms of the Contract Documents. All services provided hereunder by Contractor, either directly or through Subcontractors, shall be provided in accordance with sound construction practices and applicable professional construction standards.

A. Purpose. The purpose of the Contract Documents is to provide for the provision of construction services for the Project on the Project Site by the Contractor, and construction of the Project by the Contractor in accordance with the Project Plans and Specifications. The further purpose of the Contract Documents is to define and delineate the responsibilities and obligations of the parties to the Contract Documents and to express the desire of all such parties to cooperate to accomplish the purposes and expectations of the Contract Documents.

B. Construction Team. The Contractor, Owner and Architect/Engineer shall be called the "Construction Team" and shall work together as a team commencing upon full execution of the Contract Documents through Substantial Completion. As provided in Section 2.2, the Contractor and Architect/Engineer shall work jointly through completion and shall be available thereafter should additional services be required. The Contractor shall provide leadership to the Construction Team on all matters relating to construction. The Contractor understands, acknowledges and agrees that the Architect/Engineer shall provide leadership to the Construction Team on all matters relating to design.

C. Owner's Reliance on Bid (or Guaranteed Maximum Price Addendum). The Contractor acknowledges that the representations, statements, information and pricing contained in its Bid (or Guaranteed Maximum Price Addendum) have been relied upon by the Owner and have resulted in the award of this Project to the Contractor.

2.2 General Contractor Responsibilities. In addition to the other responsibilities set forth herein, the Contractor shall have the following responsibilities pursuant to the Contract Documents:

A. Personnel. The Contractor represents that it has secured, or shall secure, all personnel necessary to perform the Work, none of whom shall be employees of the Owner. Primary liaison between the Contractor and the Owner shall be through the Owner's Project Representative and Contractor's Project Manager. All of the services required herein shall be performed by the Contractor or under the Contractor's supervision, and all personnel engaged in the Work shall be fully qualified and shall be authorized or permitted under law to perform such services.

B. Cooperation with Architect/Engineer. The Contractor's services shall be provided in conjunction with the services of the Architect/Engineer. In the performance of professional services, the Contractor acknowledges that time is critical for Project delivery. The Contractor acknowledges that timely construction utilizing the services of an Architect/Engineer and a Contractor requires maximum cooperation between all parties.

C. Timely Performance. The Contractor shall perform all services as expeditiously as is consistent with professional skill and care and the orderly progress of the Work, in accordance with the Project Schedule. Verification of estimated Project Schedule goals will be made as requested by the Owner.

D. Duty to Defend Work. In the event of any dispute between the Owner and any Permitting Authority that relates to the quality, completeness or professional workmanship of the Contractor's services or Work, the Contractor shall, at its sole cost and expense, cooperate with the Owner to defend the quality and workmanship of the Contractor's services and Work.

E. Trade and Industry Terminology. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials, or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or laws or regulations in effect at the time of opening of Bids (or at the time of execution of the Guaranteed Maximum Price Addendum), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of Owner or Contractor, or any of their agents or employees from those set forth in the Contract Documents. Computed dimensions shall govern over scaled dimensions.

2.3 Project Schedule. The Contractor, within ten (10) days after being awarded the Agreement, shall prepare and submit for the Owner's and Architect/Engineer's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the

extent required by the Contract Documents, and shall provide for expeditious and practicable execution of Work.

A. The Project Schedule shall show a breakdown of all tasks to be performed, and their relationship in achieving the completion of each phase of Work, subject to review of Owner and Architect/Engineer and approval or rejection by Owner. The Project Schedule shall show, at a minimum, the approximate dates on which each segment of the Work is expected to be started and finished, the proposed traffic flows during each month, the anticipated earnings by the Contractor for each month and the approximate number of crews and equipment to be used. The Project Schedule shall include all phases of procurement, approval of shop drawings, proposed Change Orders in progress, schedules for Change Orders, and performance testing requirements. The Project Schedule shall include a construction commencement date and Project Substantial Completion Date, which dates shall accommodate known or reasonably anticipated geographic, atmospheric and weather conditions.

B. The Project Schedule shall serve as the framework for the subsequent development of all detailed schedules. The Project Schedule shall be used to verify Contractor performance and to allow the Owner's Project Representative to monitor the Contractor's efforts.

C. The Project Schedule may be adjusted by the Contractor pursuant to Article V. The Owner shall have the right to reschedule Work provided such rescheduling is in accord with the remainder of terms of the Contract Documents.

D. The Contractor shall prepare a submittal schedule, promptly after being awarded the Agreement and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect/Engineer's approval. The Architect/Engineer's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect/Engineer reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

E. The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect/Engineer.

2.4 Construction Services. The Contractor shall provide the following Construction Services:

A. Construction of Project. The Contractor shall work from the receipt of a Notice to Proceed through the Substantial Completion of the Project in accordance with the terms of the Contract Documents to manage the construction of the Project. The Construction Services provided by the Contractor to construct the Project shall include without limitation (1) all services

necessary and commensurate with established construction standards, and (2) all services described in the Invitation for Bid (or Request for Proposal) and the Bid (or Guaranteed Maximum Price Addendum).

B. Notice to Proceed. A Notice to Proceed may be given at any time within thirty (30) days after the effective date of the Agreement. Contractor shall start to perform the Work on the date specified in the Notice to Proceed, but no Work shall be done at the site prior to the issuance of the Notice to Proceed.

C. Quality of Work. If at any time the labor used or to be used appears to the Owner as insufficient or improper for securing the quality of Work required or the required rate of progress, the Owner may order the Contractor to increase its efficiency or to improve the character of its Work, and the Contractor shall conform to such an order. Any such order shall not entitle Contractor to any additional compensation or any increase in Contract Time. The failure of the Owner to demand any increase of such efficiency or any improvement shall not release the Contractor from its obligation to secure the quality of Work or the rate of progress necessary to complete the Work within the limits imposed by the Contract Documents. The Owner may require the Contractor to remove such personnel as the Owner deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the Project is deemed to be contrary to the Owner's interest. The Contractor shall provide good quality workmanship and shall promptly correct construction defects without additional compensation. Acceptance of the Work by the Owner shall not relieve the Contractor of the responsibility for subsequent correction of any construction defects.

D. Materials. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Architect/Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instruction of the applicable supplier except as otherwise provided in the Contract Documents.

E. Accountability for Work. The Contractor shall be solely accountable for its Work, including plans review and complete submittals. The Contractor shall be solely responsible for means, methods, techniques, sequences and procedures of construction. If a specific means, method, technique, sequence or procedure of construction is required by the Contract Documents, the Contractor may utilize an alternative means, method, technique, sequence or procedure acceptable to the Architect/Engineer if the Contractor submits sufficient information to allow the Architect/Engineer to determine that the alternative is equivalent to that required by the Contract Documents.

F. Contract Sum. The Contractor shall construct the Project so that the Project can be built for a cost not to exceed the Contract Sum.

G. Governing Specifications. In the absence of specified Owner design standards or guidelines, the Architect/Engineer shall use, and the Contractor shall comply with, the most recent version of the applicable FDOT or AASHTO design standards. In general, the Project shall be constructed by the Contractor in accordance with applicable industry standards. The Contractor shall be responsible for utilizing and maintaining current knowledge of any laws,

ordinances, codes, rules, regulations, standards, guidelines, special conditions, specifications or other mandates relevant to the Project or the services to be performed.

H. Adherence to Project Schedule. The development and equipping of the Project shall be undertaken and completed in accordance with the Project Schedule, and within the Contract Time described therein.

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

(1) The Contractor, as soon as practicable after award of the Agreement, shall furnish in writing to the Owner through the Architect/Engineer the name and qualifications of the proposed superintendent. The Architect/Engineer may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect/Engineer has reasonable objection to the proposed superintendent or (2) that the Architect/Engineer requires additional time to review. Failure of the Architect/Engineer to reply within 14 days shall constitute notice of no reasonable objection.

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

J. Work Hours. Contractor shall provide competent, suitable qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and Contractor shall not permit overtime work or the performance of Work on a Saturday, Sunday or legal holiday without Owner's written consent given after prior notice to Architect/Engineer (at least seventy-two (72) hours in advance).

K. Overtime-Related Costs. Contractor shall pay for all additional Architect/Engineer charges, inspection costs and Owner staff time for any overtime work which may be authorized. Such additional charges shall be an obligation of Contractor and no extra payment shall be made by Owner because such overtime work. At Owner's option, such overtime costs may be deducted from Contractor's monthly payment request or Contractor's retainage prior to release of final payment. Contractor's obligation to pay all overtime-related costs shall not apply if Contractor is directed by Owner to work overtime solely for Owner's convenience.

L. Insurance, Overhead and Utilities. Unless otherwise specified, Contractor shall furnish and assume full responsibility for all bonds, insurance, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

M. Cleanliness. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project Site. Contractor shall restore to original conditions all property not designated for alteration by the Contract Documents If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from Contractor.

N. Loading. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

O. Safety and Protection. Contractor shall comply with all applicable federal, state and local safety regulations. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

(1) All employees on the Work and other persons and organizations who may be affected thereby;

(2) All the Work and materials and equipment to be incorporated therein, whether in storage on or off the Project Site; and

(3) Other property at the Project Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement during construction.

Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss, and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for the protection required by public authority or local conditions. Contractor shall provide reasonable maintenance of traffic for the public and preservation of the Owner's business, taking into full consideration all local conditions. Contractor's duties and responsibilities for safety and protection with regard to the Work shall continue until such time as all the Work is completed.

P. Emergencies. In emergencies affecting the safety or protection of persons or the Work or property at the Project Site or adjacent thereto, Contractor, without special instruction or authorization from Architect/Engineer or Owner, shall act to prevent threatened damage, injury or loss. Contractor shall give Owner prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner determines that a change in the Project is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variation.

Q. Substitutes. For Substitutes not included with the Bid (or Guaranteed Maximum Price Addendum), but submitted after the effective date of the Agreement (or

Guaranteed Maximum Price Addendum), Contractor shall make written application to Architect/Engineer for acceptance thereof, certifying that the proposed Substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will also contain an itemized estimate of all costs and delays or schedule impacts that will result directly or indirectly from review, acceptance and provision of such Substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by the Architect/Engineer in evaluating the proposed Substitute. Architect/Engineer may require Contractor to furnish at Contractor's expense, additional data about the proposed Substitute. In rendering a decision, Owner, Architect/Engineer and Contractor shall have access to any available Float Time in the Project Schedule. If Substitute materials or equipment not included as part of the Bid (or Guaranteed Maximum Price Addendum), but proposed after the effective date of the Agreement, are accepted and are less costly than the originally specified materials or equipment, then the net difference in cost shall be credited to the Owner and an appropriate Change Order executed to adjust the Contract Sum.

(1) Architect/Engineer will be allowed a reasonable time within which to evaluate each proposed Substitute. Architect/Engineer will be the sole judge of acceptability and no Substitute will be ordered, installed or utilized without Architect/Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved shop drawing. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any Substitute.

(2) Contractor shall reimburse Owner for the charges of Architect/Engineer and Architect/Engineer's Consultants for evaluating each proposed Substitute submitted after the effective date of the Agreement and all costs resulting from any delays in the Work while the Substitute was undergoing review.

R. Surveys and Stakes. The Contractor shall furnish, as part of the Contract Sum, all labor, stakes, surveys, batter boards for structures, grade lines and other materials and supplies and shall set construction stakes and batter boards for establishing lines, position of structures, slopes and other controlling points necessary for the proper prosecution of the Work. Where rights-of-way, easements, property lines or any other conditions which make the lay-out of the Project or parts of the Project critical are involved, the Contractor shall employ a competent surveyor who is registered in the State of Florida for lay-out and staking. These stakes and marks shall constitute the field control by and in accord with which the Contractor shall govern and execute the Work. The Contractor shall be held responsible for the preservation of all stakes and marks and if for any reason any of the stakes or marks or batter boards become destroyed or disturbed, they shall be immediately and accurately replaced by the Contractor.

S. Suitability of Project Site. The Contractor has, by careful examination, satisfied itself as to the nature and location of the Work and all other matters which can in any way affect the Work, including, but not limited to details pertaining to borings, as shown on the drawings. Such boring information is not guaranteed to be more than a general indication of the materials likely to be found adjacent to holes bored at the Project Site, approximately at the locations indicated. The Contractor has examined boring data, where available, made its own interpretation of the subsurface conditions and other preliminary data, and has based its Bid (or Guaranteed Maximum Price Addendum) on its own opinion of the conditions likely to be

encountered. Except as specifically provided in Sections 2.4.U., 5.4 and 5.5, no extra compensation or extension of time will be considered for any Project Site conditions that existed at the time of bidding (or at the time of execution of the Guaranteed Maximum Price Addendum). No verbal agreement or conversation with any officer, agent or employee of the Owner, before or after the execution of the Agreement, shall affect or modify any of the terms or obligations herein contained.

T. Project Specification Errors. If the Contractor, during the Work, finds that the drawings, specifications or other Contract Documents cannot be followed, the Contractor shall immediately inform the Owner in writing, and the Owner shall promptly check the accuracy of the information. Any Work done after such discovery, until any necessary changes are authorized, will be done at the Contractor's sole risk of non-payment and delay.

U. Remediation of Contamination. Owner and Contractor recognize that remediation of subsurface conditions may be necessary due to potential hazardous materials contamination. Because the presence or extent of any contamination is not known, Contractor shall include no cost in the Contract Sum, and no time in the Project Schedule, for cost or delays that might result from any necessary remediation. The Project Schedule will provide a period of time between demolition activities and the start of the next activity to commence any remediation if needed. Contractor shall use all reasonable efforts in scheduling the Project to minimize the likelihood that remediation delays construction. Any hazardous materials remediation Work which Contractor agrees to perform shall be done pursuant to a Change Order or amendment consistent with the following:

(1) The dates of Substantial Completion shall be equitably adjusted based on delays, if any, incurred in connection with remediation efforts.

(2) Contractor, and any Subcontractors which have mobilized on the Project Site, shall be paid for demonstrated costs of overhead operations at the Project Site during any period of delay of more than seven (7) days, except to the extent that Work proceeds concurrently with remediation. The categories of costs to be reimbursed are limited to those reasonably incurred at the jobsite during the delay period (such as trailers or offices, telephones, faxes, and the like); equipment dedicated to the Project and located at the Project Site; salaries and associated costs of personnel dedicated to the Project to the extent that they do not perform work on other projects; and other jobsite costs that are reasonable and which are incurred during the delay period. Subcontractors and suppliers which have not mobilized are limited to the costs set forth in Section 2.4.U(3).

(3) Contractor and any Subcontractor or supplier on the Project who is eligible for compensation shall be paid any demonstrated costs of escalation in materials or labor, and reasonable costs of off-site storage of materials identified to the Project, arising because of any delay of more than seven (7) days. Such Contractor, Subcontractors and suppliers are obligated to take all reasonable steps to mitigate escalation costs, such as through early purchase of materials.

(4) Contractor, for itself and all Subcontractors and suppliers on the Project, hereby agrees that the extension of time for delays under Section 2.4.U(1), and payment of the costs identified in Sections 2.4.U(2) and/or Section 2.4.U(3), are the sole remedies for costs and delays described in this Section, and waives all claims and demands for extended home office overhead (including, but not limited to, "Eichleay" claims), lost profit or lost opportunities, and any special, indirect, or consequential damages arising as a result of delays described in this Section. The Contract Sum shall be adjusted to reflect payment of allowable costs.

(5) If any delay described in this section causes the time or cost for the Project to exceed the Contract Time or the Contact Sum, then the Owner may terminate the Agreement pursuant to Section 14.2.

(6) Contractor and any Subcontractor or supplier seeking additional costs under this Section 2.4.U. shall promptly submit estimates or any costs as requested by Owner, and detailed back-up for all costs when payment is sought or whenever reasonably requested by Owner. All costs are auditable, at Owner's discretion. Bid, estimate and pricing information reasonably related to any request for additional compensation will be provided promptly upon request.

(7) Contractor shall include provisions in its subcontracts and purchase orders consistent with this Section.

V. Interfacing.

(1) The Contractor shall take such measures as are necessary to ensure proper construction and delivery of the Project, including but not limited to providing that all procurement of long-lead items, the separate construction Subcontractors, and the general conditions items are performed without duplication or overlap to maintain completion of all Work on schedule. Particular attention shall be given to provide that each Subcontractor bid package clearly identifies the Work included in that particular separate subcontract, its scheduling for start and completion, and its relationship to other separate contractors.

(2) Without assuming any design responsibilities of the Architect/Engineer, the Contractor shall include in the Progress Reports required under this Section 2.4 comments on overlap with any other separate subcontracts, omissions, lack of correlation between drawings, and any other deficiencies noted, in order that the Architect/Engineer may arrange for necessary corrections.

W. Job Site Facilities. The Contractor shall arrange for all job site facilities required and necessary to enable the Contractor and Architect/Engineer to perform their respective duties and to accommodate any representatives of the Owner which the Owner may choose to have present on the Project Site.

X. Weather Protection. The Contractor shall provide temporary enclosures of building areas to assure orderly progress of the Work during periods when extreme weather conditions are likely to be experienced. The Contractor shall also be responsible for providing weather protection for Work in progress and for materials stored on the Project Site. A contingency plan shall be prepared upon request of the Owner for weather conditions that may affect the construction.

Y. Payment and Performance Bond. Prior to the construction commencement date, the Contractor shall obtain, for the benefit of and directed to the Owner, a Payment and Performance Bond satisfying the requirements of Section 255.05, Florida Statutes, covering the faithful performance by the Contractor of its obligations under the Contract Documents, including but not limited to the construction of the Project on the Project Site and the payment of all obligations arising thereunder, including all payments to Subcontractors, laborers, and materialmen. The surety selected by the Contractor to provide the Payment and Performance Bond shall be approved by the Owner prior to the issuance of such Bond, which approval shall not be unreasonably withheld or delayed provided that the surety is rated A or better by Best's Key Guide, latest edition. For Changes in the Work that result in an increase in the Contract Sum, Owner reserves the right to require the Contractor to secure and deliver additive riders to the Payment and Performance Bond.

Z. Construction Phase; Building Permit; Code Inspections. Unless otherwise provided, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work.

(1) Building Permit. The Owner and Architect/Engineer shall provide such information to any Permitting Authority as is necessary to obtain approval from the Permitting Authority to commence construction prior to beginning construction. The Contractor shall pull any required building permit, and shall be responsible for delivering and posting the building permit at the Project Site prior to the commencement of construction. The cost of the building permit is included in the Contract Sum. The Owner and Architect/Engineer shall fully cooperate with the Contractor when and where necessary.

(2) Code Inspections. The Project requires detailed code compliance inspection during construction in disciplines determined by any Permitting Authority. These disciplines normally include, but are not necessarily limited to, structural, mechanical, electrical, plumbing, general building and fire. The Contractor shall notify the appropriate inspector(s) and the Architect/Engineer, no less than 24 hours in advance, when the Work is ready for inspection and before the Work is covered up. All inspections shall be made for conformance with the applicable ordinances and building codes. Costs for all re-inspections of Work found defective and subsequently repaired shall not be included as Project Costs and shall be borne by the Contractor or as provided in the contract between Contractor and Subcontractor.

(3) Contractor's Personnel. The Contractor shall maintain sufficient off-site support staff and competent full-time staff at the Project Site authorized to act on behalf of the Contractor to coordinate, inspect, and provide general direction of the Work and progress of the Subcontractors. At all times during the performance of the Work, the Owner shall have the right to demand replacement of Contractor Personnel to whom the Owner has reasonable objection, without liability to the Contractor.

(4) Lines of Authority. To provide general direction of the Work, the Contractor shall establish and maintain lines of authority for its personnel and shall provide this information to the Owner and all other affected parties, such as the code inspectors of any Permitting Authority, the Subcontractors, and the Architect/Engineer. The Owner and Architect/Engineer may attend meetings between the Contractor and his Subcontractors; however, such attendance is optional and shall not diminish either the authority or responsibility of the Contractor to administer the subcontracts.

AA. Quality Control. The Contractor shall develop and maintain a program, acceptable to the Owner and Architect/Engineer, to assure quality control of the construction. The Contractor shall be responsible for and supervise the Work of all Subcontractors, providing instructions to each when their Work does not conform to the requirements of the Project Plans and Specifications, and the Contractor shall continue to coordinate the Work of each Subcontractor to ensure that corrections are made in a timely manner so as to not affect the efficient progress of the Work. Should a disagreement occur between the Contractor and the Architect/Engineer over the acceptability of the Work, the Owner, at its sole discretion and in addition to any other remedies provided herein, shall have the right to determine the acceptability, provided that such determination is consistent with standards for construction projects of this type and generally accepted industry standards for workmanship in the State of Florida.

BB. Management of Subcontractors. All Subcontractors shall be compensated in accordance with Article IV. The Contractor shall solely control the Subcontractors. The Contractor shall negotiate all Change Orders and Field Orders with all affected Subcontractors and shall review the costs and advise the Owner and Architect/Engineer of their validity and reasonableness, acting in the Owner's best interest. When there is an imminent threat to health and safety, and Owner's Project Representative concurrence is impractical, the Contractor shall act immediately to remove the threats to health and safety and shall subsequently fully inform Owner of all such action taken. The Contractor shall also carefully review all shop drawings and then forward the same to the Architect/Engineer for review and actions. The Architect/Engineer will transmit them back to the Contractor, who will then issue the shop drawings to the affected Subcontractor for fabrication or revision. The Contractor shall maintain a suspense control system to promote expeditious handling. The Contractor shall request the Architect/Engineer to make interpretations of the drawings or specifications requested of him by the Subcontractors and shall maintain a business system to promote timely response. The Contractor shall inform the Architect/Engineer which shop drawings or requests for clarification have the greatest urgency, to enable the Architect/Engineer to prioritize requests coming from the Contractor. The Contractor shall advise the Owner and Architect/Engineer when timely response is not occurring on any of the above.

CC. Job Requirements.

(1) The Contractor shall provide each of the following as a part of its services hereunder:

(a) Maintain a log of daily activities, including manpower records, equipment on site, weather, delays, major decisions, etc;

(b) Maintain a roster of companies on the Project with names and telephone numbers of key personnel;

(c) Establish and enforce job rules governing parking, clean-up, use of facilities, and worker discipline;

(d) Provide labor relations management and equal opportunity employment for a harmonious, productive Project;

(e) Provide and administer a safety program for the Project and monitor for subcontractor compliance without relieving them of responsibilities to perform Work in accordance with best acceptable practice;

(f) Provide a quality control program as provided under Section 2.4.C above;

(g) Provide miscellaneous office supplies that support the construction efforts which are consumed by its own forces;

(h) Provide for travel to and from its home office to the Project Site and to those other places within Manatee County as required by the Project;

(i) Verify that tests, equipment, and system start-ups and operating and maintenance instructions are conducted as required and in the presence of the required personnel and provide adequate records of same to the Architect/Engineer;

(j) Maintain at the job site orderly files for correspondence, reports of job conferences, shop drawings and sample submissions, reproductions of original Contract Documents including all addenda, change orders, field orders, additional drawings issued after execution of the Agreement, Owner/Architect/Engineer's clarifications and interpretations of the Contract Documents, Progress Reports, as-built drawings, and other project related documents;

(k) Keep a diary or log book, recording hours on the job site, weather conditions, data relative to questions of extras or deductions; list of visiting officials and representatives or manufacturers, fabricators,

suppliers and distributors; daily activities, decisions, observations in general and specific observations in more detail as in the case of observing test procedures, and provide copies of same to Owner/Architect/Engineer;

(l) Record names, addresses and telephone numbers of all Contractors, Subcontractors and major suppliers of materials and equipment;

(m) Furnish Owner/Architect/Engineer periodic reports, as required, of progress of the Work and Contractor's compliance with the approved progress schedule and schedule of shop drawing submissions;

(n) Consult with Owner/Architect/Engineer in advance of scheduling major tests, inspections or start of important phases of the Work;

(o) Verify, during the course of the Work, that certificates, maintenance and operations manuals and other data required to be assembled and furnished are applicable to the items actually installed, and deliver same to Owner/Architect/Engineer for review prior to final Acceptance of the Work; and

(p) Cooperate with Owner in the administration of grants.

(2) The Contractor shall provide personnel and equipment, or shall arrange for separate Subcontractors to provide each of the following as a Project Cost:

(a) Services of independent testing laboratories, and provide the necessary testing of materials to ensure conformance to contract requirements; and

(b) Printing and distribution of all required bidding documents and shop drawings, including the sets required by Permitting Authority inspectors.

DD. As-Built Drawings. The Contractor shall continuously review as-built drawings and mark up progress prints to provide as much accuracy as possible. Prior to, and as a requirement for authorizing final payment to the Contractor due hereunder, the Contractor shall provide to the Owner an original set of marked-up, as-built Project Plans and Specifications and an electronic format of those records showing the location and dimensions of the Project as constructed, which documents shall be certified as being correct by the Contractor and the Architect/Engineer. Final as-built drawings shall be signed and sealed by a registered Florida surveyor.

EE. Progress Reports. The Contractor shall forward to the Owner, as soon as practicable after the first day of each month, a summary report of the progress of the various parts of the Work, to include those parts of the Work in fabrication and in the field, stating the existing status, estimated time of completion and cause of delay, if any. Together with the summary report, the Contractor shall submit any necessary revisions to the original schedule for the Owner's review

and approval. In addition, more detailed schedules may be required by the Owner for daily traffic control.

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

(1) Contractor shall use its best efforts and due diligence to ensure that during the warranty period, those entities or individuals who have provided direct warranties to the Owner as required by the Contract Documents perform all required warranty Work in a timely manner and at the sole cost and expense of such warranty providers. Any such cost or expense not paid by the warranty providers shall be paid by the Contractor, to include any costs and attorney's fees incurred in warranty-related litigation between Contractor and any Subcontractors.

(2) The Contractor shall secure guarantees and warranties of Subcontractors, equipment suppliers and materialmen, and assemble and deliver same to the Owner in a manner that will facilitate their maximum enforcement and assure their meaningful implementation. The Contractor shall collect and deliver to the Owner any specific written guaranties or warranties given by others as required by subcontracts.

(3) At the Owner's request, the Contractor shall conduct, jointly with the Owner and the Architect/Engineer, no more than two (2) warranty inspections within three (3) years after the Substantial Completion Date.

GG. Apprentices. If Contractor employs apprentices, their performance of Work shall be governed by and shall comply with the provisions of Chapter 446, Florida Statutes.

HH. Schedule of Values. Unit prices shall be established for this Agreement by the submission of a schedule of values within ten (10) days of receipt of the Notice to Proceed. The schedule shall include quantities and prices of items equaling the Contract Sum and will subdivide the Work into components in sufficient detail to serve as the basis for progress payments during construction. Such prices shall include an appropriate amount of overhead and profit applicable to each item of Work. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

II. Other Contracts. The Owner reserves the right to let other contracts in connection with this Work. The Contractor shall afford other contractors reasonable

opportunity for the introduction and storage of their materials and execution of their work, and promptly connect and coordinate the Work with theirs.

ARTICLE III
COMPENSATION

3.1 Compensation. The Contract Sum constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Sum.

A. Adjustments. The Contract Sum may only be changed by Change Order or by a written amendment. Any claim for an increase or decrease in the Contract Sum shall be based on written notice delivered by the party making the claim to the other party. Notice of the amount of the claim with supporting data shall be delivered within fifteen (15) days from the beginning of such occurrence and shall be accompanied by claimant's written statement that the amount claimed covers all amounts to which the claimant is entitled as a result of the occurrence of said event. Failure to deliver a claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

B. Valuation. The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Sum shall be determined in one of the following ways (at Owner's discretion):

(1) In the case of Unit Price Work, in accordance with Section 3.1.C, below; or

(2) By mutual acceptance of a lump sum; or

(3) On the basis of the cost of the Work, plus a negotiated Contractor's fee for overhead and profit. Contractor shall submit an itemized cost breakdown together with supporting data.

C. Unit Price Work. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment pursuant to a requested Change Order under the following conditions:

(1) If the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Sum and the variation in the quantity of the particular item of Unit Price Work performed by Contractor differs by more than 15% from the estimated quantity of such item indicated in the Agreement; and

(2) If there is no corresponding adjustment with respect to any other item of Work; and

(i) If Contractor believes that it has incurred additional expense as a result thereof; or

(ii) If Owner believes that the quantity variation entitles it to an

adjustment in the unit price; or

(iii) If the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

3.2 Schedule of Compensation. All payments for services and material under the Contract Documents shall be made in accordance with the following provisions.

A. Periodic Payments for Services. The Contractor shall be entitled to receive payment for Construction Services rendered pursuant to Section 2.4 in periodic payments which shall reflect a fair apportionment of cost and schedule of values of services furnished prior to payment, subject to the provisions of this Section.

B. Payment for Materials and Equipment. In addition to the periodic payments authorized hereunder, payments may be made for material and equipment not incorporated in the Work but delivered and suitably stored at the Project Site, or another location, subject to prior approval and acceptance by the Owner on each occasion.

C. Credit toward Contract Sum. All payments for Construction Services made hereunder shall be credited toward the payment of the Contract Sum as Contractor's sole compensation for the construction of the Project.

3.3 Invoice and Payment. All payments for services and materials under the Contract Documents shall be invoiced and paid in accordance with the following provisions.

A. Invoices. The Contractor shall submit to the Owner periodic invoices for payment, in a form acceptable to the Owner, which shall include a sworn statement certifying that, to the best of the Contractor's knowledge, information and belief, the construction has progressed to the point indicated, the quality and the Work covered by the invoice is in accord with the Project Plans and Specifications, and the Contractor is entitled to payment in the amount requested, along with the cost reports required pursuant to Article II, showing in detail all monies paid out, Project Costs accumulated, or Project Cost incurred during the previous period. This data shall be attached to the invoice.

B. Additional Information; Processing of Invoices. Should an invoiced amount appear to exceed the Work effort believed to be completed, the Owner may, prior to processing of the invoice for payment, require the Contractor to submit satisfactory evidence to support the invoice. All Progress Reports and invoices shall be delivered to the attention of the Owner's Project Representative. Invoices not properly prepared (mathematical errors, billing not reflecting actual Work done, no signature, etc.) shall be returned to the Contractor for correction.

C. Architect/Engineer's Approval. Payment for Work completed shall be subject to the Architect/Engineer approving the payment requested by the Contractor and certifying the amount thereof that has been properly incurred and is then due and payable to the Contractor, and identifying with specificity any amount that has not been properly incurred and that should not be paid.

D. Warrants of Contractor with Respect to Payments. The Contractor warrants that (1) upon payment of any retainage, materials and equipment covered by a partial payment

request will pass to Owner either by incorporation in construction or upon receipt of payment by the Contractor, whichever occurs first; (2) Work, materials and equipment covered by previous partial payment requests shall be free and clear of liens, claims, security interests, or encumbrances; and (3) no Work, materials or equipment covered by a partial payment request which has been acquired by the Contractor or any other person performing Work at the Project Site, or furnishing materials or equipment for the Project, shall be subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or any other person.

E. All Compensation Included. Contractor's compensation includes full payment for services set forth in the Contract Documents, including but not limited to overhead, profit, salaries or other compensation of Contractor's officers, partners and/or employees, general operating expenses incurred by Contractor and relating to this Project, including the cost of management, supervision and data processing staff, job office equipment and supplies, and other similar items.

ARTICLE IV
SUBCONTRACTORS

4.1 Subcontracts. At the Owner's request, the Contractor shall provide Owner's Project Representative with copies of all proposed and final subcontracts, including the general and supplementary conditions thereof.

A. Subcontracts Generally. All subcontracts shall: (1) require each Subcontractor to be bound to Contractor to the same extent Contractor is bound to Owner by the terms of the Contract Documents, as those terms may apply to the portion of the Work to be performed by the Subcontractor, (2) provide for the assignment of the subcontracts from Contractor to Owner at the election of Owner, upon termination of Contractor, (3) provide that Owner will be an additional indemnified party of the subcontract, (4) provide that Owner will be an additional insured on all insurance policies required to be provided by the Subcontractor, except workers' compensation, (5) assign all warranties directly to Owner, and (6) identify Owner as an intended third-party beneficiary of the subcontract.

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

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

B. No Damages for Delay. Except when otherwise expressly agreed to by Owner in writing, all subcontracts shall provide:

> "LIMITATION OF REMEDIES – NO DAMAGES FOR DELAY. The Subcontractor's exclusive remedy for delays in the performance of the

contract caused by events beyond its control, including delays claimed to be caused by the Owner or Architect/Engineer or attributable to the Owner or Architect/Engineer and including claims based on breach of contract or negligence, shall be an extension of its contract time and shall in no way involve any monetary claim."

Each subcontract shall require that any claims by the Subcontractor for delay must be submitted to the Contractor within the time and in the manner in which the Contractor must submit such claims to the Owner, and that failure to comply with the conditions for giving notice and submitting claims shall result in the waiver of such claims.

C. Subcontractual Relations. The Contractor shall require each Subcontractor to assume all the obligations and responsibilities which the Contractor owes the Owner pursuant to the Contract Documents, by the parties to the extent of the Work to be performed by the Subcontractor. Said obligations shall be made in writing and shall preserve and protect the rights of the Owner and Architect/Engineer, with respect to the Work to be performed by the Subcontractor, so that the subcontracting thereof will not prejudice such rights. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with its sub-subcontractors.

D. Insurance; Acts and Omissions. Insurance requirements for Subcontractors shall be no more stringent than those requirements imposed on the Contractor by the Owner. The Contractor shall be responsible to the Owner for the acts and omissions of its employees, agents, Subcontractors, their agents and employees, and all other persons performing any of the Work or supplying materials under a contract to the Contractor.

4.2 Relationship and Responsibilities. Except as specifically set forth herein with respect to direct materials acquisitions by Owner, nothing contained in the Contract Documents or in any Contract Document does or shall create any contractual relation between the Owner or Architect/Engineer and any Subcontractor. Specifically, the Contractor is not acting as an agent of the Owner with respect to any Subcontractor. The utilization of any Subcontractor shall not relieve Contractor from any liability or responsibility to Owner, or obligate Owner to the payment of any compensation to the Subcontractor or additional compensation to the Contractor.

4.3 Payments to Subcontractors; Monthly Statements. The Contractor shall be responsible for paying all Subcontractors from the payments made by the Owner to Contractor pursuant to Article III, subject to the following provisions:

A. Payment. The Contractor shall, no later than ten (10) days after receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, pay to each Subcontractor the amount to which the Subcontractor is entitled in accordance with the terms of the Contractor's contract with such Subcontractor. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-Subcontractors in a similar manner. After receipt of payment from Owner, if the need should arise to withhold payments to Subcontractors for any reason, as solely determined by Contractor, the Contractor shall promptly restore such monies to the Owner, adjusting subsequent pay requests and Project bookkeeping as required.

B. Final Payment of Subcontractors. The final payment of retainage to Subcontractors shall not be made until the Project has been inspected by the Architect/Engineer or other person designated by the Owner for that purpose, and until both the Architect/Engineer and the Contractor have issued a written certificate that the Project has been constructed in accordance with the Project Plans and Specifications and approved Change Orders. Before issuance of final payment to any Subcontractor without any retainage, the Subcontractor shall submit satisfactory evidence that all payrolls, material bills, and other indebtedness connected with the Project have been paid or otherwise satisfied, warranty information is complete, as-built markups have been submitted, and instruction for the Owner's operating and maintenance personnel is complete. Final payment may be made to certain select Subcontractors whose Work is satisfactorily completed prior to the completion of the Project, but only upon approval of the Owner's Project Representative.

4.4 Responsibility for Subcontractors. As provided in Section 2.4.BB, Contractor shall be fully responsible to Owner for all acts and omissions of the Subcontractors, suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect Contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions.

4.5 Contingent Assignment of Subcontracts. Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that:

(1) assignment is effective only after termination of the Contract by the Owner for cause pursuant to Article XIV and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

(2) assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Agreement.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract. Upon such assignment, if the Work has been suspended for more than thirty (30) days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension. Upon such assignment to the Owner, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE V
CHANGES IN WORK

5.1 General. Changes in the Work may be accomplished after execution of the Agreement, and without invalidating the Agreement, by Change Order, Work Directive Change or order for a minor change in the Work, subject to the limitations stated in this Article V and elsewhere in the Contract Documents. A Change Order shall be based upon agreement among the Owner, Contractor and Architect/Engineer; a Work Directive Change requires agreement by the Owner and Architect/Engineer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect/Engineer alone. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor

shall proceed promptly, unless otherwise provided in the Change Order, Work Directive Change or order for a minor change in the Work.

5.2 Minor Changes in the Work. The Owner or Architect/Engineer shall have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such change will be effected by written order signed by the Architect/Engineer and shall be binding on the Owner and Contractor. The Contractor shall abide by and perform such minor changes. Such changes shall be effected by a Field Directive or a Work Directive Change. Documentation of changes shall be determined by the Construction Team, and displayed monthly in the Progress Reports. Because such changes shall not affect the Contract Sum to be paid to the Contractor, they shall not require a Change Order pursuant to Section 5.6.

5.3 Emergencies. In any emergency affecting the safety of persons or property, the Contractor shall act at its discretion to prevent threatened damage, injury, or loss. Any increase in the Contract Sum or extension of time claimed by the Contractor because of emergency Work shall be determined as provided in Section 5.6. However, whenever practicable, the Contractor shall obtain verbal concurrence of the Owner's Project Representative and Architect/Engineer where the act will or may affect the Contract Sum or Contract Time.

5.4 Concealed Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect/Engineer before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Architect/Engineer will promptly investigate such conditions and, if the Architect/Engineer determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect/Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect/Engineer shall promptly notify the Owner and Contractor in writing, stating the reasons. If the Contractor disputes the Architect/Engineer's determination or recommendation, the Contractor may proceed as provided in Article VIII. If the Owner disputes the Architect/Engineer's determination or recommendation, the Owner may appeal directly to the Purchasing Official and shall thereafter follow the process set forth in Section 8.5.

5.5 Hazardous Materials. In the event the Contractor encounters on the Project Site material reasonably believed to be hazardous, petroleum or petroleum related products, or other hazardous or toxic substances, except as provided in Section 2.4.U, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and the Architect/Engineer in writing. The Work in the affected area shall not thereafter be resumed except by Change Order or written amendment, if in fact the material or substance has not been rendered harmless. The Work in the affected area shall be resumed when the Project Site has been rendered harmless, in accordance with the final determination by the Architect/Engineer or other appropriate professional employed by Owner. The Contractor shall not be required to perform without its consent any Work relating to hazardous materials, petroleum or petroleum related products, or

other hazardous or toxic substances. In the event the Contractor encounters on the Project Site materials believed in good faith to be hazardous or contaminated material, and the presence of such hazardous or contaminated material was not known and planned for at the time the Contractor submitted its Bid (or Guaranteed Maximum Price proposal), and it is necessary for the Contractor to stop Work in the area affected and delays Work for more than a seven (7) day period, adjustments to the Contract Sum and/or Contract Time shall be made in accordance with this Article V.

5.6 Change Orders; Adjustments to Contract Sum.

A. Change Orders Generally. The increase or decrease in the Contract Sum resulting from a change authorized pursuant to the Contract Documents shall be determined:

(1) By mutual acceptance of a lump sum amount properly itemized and supported by sufficient substantiating data, to permit evaluation by the Architect/Engineer and Owner; or

(2) By unit prices stated in the Agreement or subsequently agreed upon; or

(3) By any other method mutually agreeable to Owner and Contractor.

If Owner and Contractor are unable to agree upon increases or decreases in the Contract Sum and the Architect/Engineer certifies that the work needs to be commenced prior to any such agreement, the Contractor, provided it receives a written Change Order signed by or on behalf of the Owner, shall promptly proceed with the Work involved. The cost of such Work shall then be determined on the basis of the reasonable expenditures of those performing the Work attributed to the change. However, in the event a Change Order is issued under these conditions, the Owner, through the Architect/Engineer, will establish an estimated cost of the Work and the Contractor shall not perform any Work whose cost exceeds that estimated without prior written approval by the Owner. In such case, the Contractor shall keep and present in such form as the Owner may prescribe an itemized accounting, together with appropriate supporting data of the increase in overall costs of the Project. The amount of any decrease in the Contract Sum to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in costs will be the amount of the actual net decrease.

5.7 Owner-Initiated Changes. Without invalidating the Agreement and without notice to any Surety, Owner may, at any time, order additions, deletions or revisions in the Work. These will be authorized by a written amendment, a Field Directive, a Change Order, or a Work Directive Change, as the case may be. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided). A Work Directive Change may not change the Contract Sum or the Contract Time; but is evidence that the parties expect that the change directed or documented by a Work 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 Sum or Contract Time.

5.8 Unauthorized Work. Contractor shall not be entitled to an increase in the Contract Sum or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents.

5.9 Defective Work. Owner and Contractor shall execute appropriate Change Orders (or written amendments) covering changes in the Work which are ordered by Owner, or which may be required because of acceptance of defective Work, without adjustment to the Contract Sum.

5.10 Estimates for Changes. At any time Architect/Engineer may request a quotation from Contractor for a proposed change in the Work. Within twenty-one (21) calendar days after receipt, Contractor shall submit a written and detailed proposal for an increase or decrease in the Contract Sum or Contract Time for the proposed change. Architect/Engineer shall have twenty-one (21) calendar days after receipt of the detailed proposal to respond in writing. The proposal shall include an itemized estimate of all costs and time for performance that will result directly or indirectly from the proposed change. Unless otherwise directed, itemized estimates shall be in sufficient detail to reasonably permit an analysis by Architect/Engineer of all material, labor, equipment, subcontracts, overhead costs and fees, and shall cover all Work involved in the change, whether such Work was deleted, added, changed or impacted. Notwithstanding the request for quotation, Contractor shall carry on the Work and maintain the progress schedule. Delays in the submittal of the written and detailed proposal will be considered non-prejudicial.

5.11 Form of Proposed Changes. The form of all submittals, notices, Change Orders and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Owner. Standard Owner forms shall be utilized.

5.12 Changes to Contract Time. The Contract Time may only be changed pursuant to a Change Order or a written amendment to the Contract Documents. Any claim for an extension or shortening of the Contract Time shall be based on written notice delivered by the party making the claim to the other party. Notice of the extent of the claim with supporting data shall be delivered within fifteen (15) days from detection or beginning of such occurrence and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled to because of the occurrence of said event. The Contract time will be extended in an amount equal to time lost due to delays beyond the control of Contractor. Such delays shall include, but not be limited to, acts or neglect by Owner or others performing additional Work; or to fires, floods, epidemics, abnormal weather conditions or acts of God. Failure to deliver a written notice of claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

ARTICLE VI
ROLE OF ARCHITECT/ENGINEER

6.1 General.

A. Retaining. The Owner shall retain an Architect/Engineer (whether an individual or an entity) lawfully licensed to practice in Florida. That person or entity is identified as the Architect/Engineer in the Agreement and is referred to throughout the Contract Documents as if singular in number.

B. Duties. Duties, responsibilities and limitations of authority of the Architect/Engineer as set forth in the Contract Documents shall not be restricted, modified or

extended without written consent of the Owner and Architect/Engineer. Consent shall not be unreasonably withheld.

C. Termination. If the employment of the Architect/Engineer is terminated, the Owner shall employ a successor Architect/Engineer as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect/Engineer.

6.2 Administration. The Architect/Engineer will provide administration of the Agreement as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect/Engineer approves the final Application for Payment. The Architect/Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

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

B. Reporting. Based on the site visits, the Architect/Engineer will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect/Engineer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect/Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

6.3 Interpretation of Project Plans and Specifications. The Architect/Engineer will be the interpreter of the requirements of the Project Plans and Specifications. Upon receipt of comments or objections by Contractor or Owner, the Architect/Engineer will make decisions on all claims, disputes, or other matters pertaining to the interpretation of the Project Plans and Specifications.

6.4 Rejection of Non-Conforming Work. Upon consultation with Owner, the Architect/Engineer shall have the authority to reject Work which does not conform to the Project Plans and Specifications.

6.5 Correction of Work. The Contractor shall promptly correct all Work rejected by the Architect/Engineer for being defective or as failing to conform to the Project Plans and Specifications, whether observed before or after the Substantial Completion Date and whether or not fabricated, installed, or completed. The Contractor shall bear all costs of correcting such

rejected Work, including compensation for Architect/Engineer's additional services made necessary thereby.

6.6 Timely Performance of Architect/Engineer. The Contractor shall identify which requests for information or response from the Architect/Engineer have the greatest urgency and those items which require prioritizing in response by the Architect/Engineer. The Contractor shall also identify the preferred time period for response and shall request a response time which is reasonably and demonstrably related to the needs of the Project and Contractor. If Architect/Engineer claims that Contractor's expectations for a response are unreasonable, Owner shall require Architect/Engineer to communicate such claim to Contractor in writing together with the specific time necessary to respond and the date upon which such response will be made. If Contractor believes that Architect/Engineer is not providing timely services or responses, Contractor shall notify Owner of same in writing not less than two (2) weeks before Contractor believes performance or response time from Architect/Engineer is required without risk of delaying the Project.

ARTICLE VII
OWNER'S RIGHTS AND RESPONSIBILITIES

7.1 Project Site; Title. The Owner shall provide the lands upon which the Work under the Contract Documents is to be done, except that the Contractor shall provide all necessary additional land required for the erection of temporary construction facilities and storage of his materials, together with right of access to same. The Owner hereby represents to the Contractor that it currently has and will maintain up through and including the Substantial Completion Date, good title to all of the real property constituting the Project Site. Owner agrees to resolve, at its expense, any disputes relating to the ownership and use of the Project Site which might arise during construction.

7.2 Project Plans and Specifications; Architect/Engineer. The parties hereto acknowledge and agree that Owner has previously entered into an agreement with Architect/Engineer. Pursuant to the terms of such agreement, the Architect/Engineer, as an agent and representative of Owner, is responsible for the preparation of Project Plans and Specifications which consist of drawings, specifications, and other documents setting forth in detail the requirements for the construction of the Project. All such Project Plans and Specifications shall be provided either by Owner or the Architect/Engineer, and Contractor shall be under no obligation to provide same and shall be entitled to rely upon the accuracy and completeness of the Project Plans and Specifications provided by the Architect/Engineer and all preliminary drawings prepared in connection therewith. The Contractor will be furnished a reproducible set of all drawings and specifications reasonably necessary for the performance of Contractor's services hereunder and otherwise ready for printing. The Contractor shall be notified of any written modification in the agreement between Owner and Architect/Engineer.

7.3 Surveys; Soil Tests and Other Project Site Information. Owner shall be responsible for providing a legal description and certified land survey of the Project Site in a form and content and with such specificity as may be required by the Architect/Engineer and Contractor to perform their services. To the extent deemed necessary by Owner and Architect/Engineer, and solely at Owner's expense, Owner may engage the services of a geotechnical consultant to perform test borings and other underground soils testing as may be deemed necessary by the Architect/Engineer or the Contractor. Contractor shall not be obligated to provide such surveys or

soil tests and shall be entitled to rely upon the accuracy and completeness of the information provided; subject, however, to the provisions of Section 2.4.S hereof. Owner shall provide Contractor, as soon as reasonably possible following the execution of the Contract Documents, all surveys or other survey information in its possession describing the physical characteristics of the Project Site, together with soils reports, subsurface investigations, utility locations, deed restrictions, easements, and legal descriptions then in its possession or control. Upon receipt of all surveys, soils tests, and other Project Site information, Contractor shall promptly advise Owner of any inadequacies in such information and of the need for any additional surveys, soils or subsoil tests. In performing this Work, Contractor shall use the standard of care of experienced contractors and will use its best efforts timely to identify all problems or omissions. Owner shall not be responsible for any delay or damages to the Contractor for any visible or disclosed site conditions or disclosed deficiencies in the Project Site which should have been identified by Contractor and corrected by Owner prior to the execution of the Contract Documents.

7.4 Information; Communication; Coordination. The Owner's Project Representative shall examine any documents or requests for information submitted by the Contractor and shall advise Contractor of Owner's decisions pertaining thereto within a reasonable period of time to avoid unreasonable delay in the progress of the Contractor's services. Contractor shall indicate if any such documents or requests warrant priority consideration. However, decisions pertaining to approval of the Project Schedule as it relates to the date of Substantial Completion, the Project Cost, Contractor's compensation, approving or changing the Contract Sum shall only be effective when approved by Owner in the form of a written Change Order or amendment to the Contract Documents. Owner reserves the right to designate a different Owner's Project Representative provided Contractor is notified in writing of any such change. Owner and Architect/Engineer may communicate with Subcontractors, materialmen, laborers, or suppliers engaged to perform services on the Project, but only for informational purposes. Neither the Owner nor the Architect/Engineer shall attempt to direct the Work of or otherwise interfere with any Subcontractor, materialman, laborer, or supplier, or otherwise interfere with the Work of the Contractor. Owner shall furnish the data required of Owner under the Contract Documents promptly.

7.5 Governmental Body. The Contractor recognizes that the Owner is a governmental body with certain procedural requirements to be satisfied. The Contractor has and will make reasonable allowance in its performance of services for such additional time as may be required for approvals and decisions by the Owner and any other necessary government agency.

7.6 Pre-Completion Acceptance. The Owner shall have the right to take possession of and use any completed portions of the Work, although the time for completing the entire Work or such portions may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

7.7 Ownership and Use of Drawings, Specifications and Other Instruments of Service.

(1) The Architect/Engineer and the Architect/Engineer's consultants shall be deemed the authors and owners of their respective instruments of service, including the Project Plans and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The

Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the instruments of service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be constructed as publication in derogation of the Architect/Engineer's or Architect/Engineer's consultants' reserved rights.

(2) The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the drawings and specifications provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Project Plans and Specifications or other instruments of service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the drawings or specifications on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect/Engineer and the Architect/Engineer's consultants.

7.8 Owner's Project Representative. Owner's Project Representative is Owner's Agent, who will act as directed by and under the supervision of the Owner, and who will confer with Owner/Architect/Engineer regarding his actions. The Owner's Project Representative's dealings in matters pertaining to the on-site Work shall, in general, be only with the Owner/Architect/Engineer and Contractor and dealings with Subcontractors shall only be through or with the full knowledge of Contractor.

A. Responsibilities. Except as otherwise instructed in writing by Owner, the Owner's Project Representative will:

(1) Attend preconstruction conferences; arrange a schedule of progress meetings and other job conferences as required in consultation with Owner/Architect/Engineer and notify those expected to attend in advance; and attend meetings and maintain and circulate copies of minutes thereof;

(2) Serve as Owner/Architect/Engineer's liaison with Contractor, working principally through Contractor's superintendent, to assist in understanding the intent of the Contract Documents. As requested by Owner/Architect/Engineer, assist in obtaining additional details or information when required at the job site for proper execution of the Work;

(3) Report to Owner/Architect/Engineer whenever he believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents;

(4) Accompany visiting inspectors representing public or other agencies having jurisdiction over the project; record the outcome of these inspections and report to Owner/Architect/Engineer;

(5) Review applications for payment with Contractor for compliance with the established procedure for their submission and forward them with recommendations to Owner/Architect/Engineer; and

(6) Perform those duties as set forth elsewhere within the Contract Documents.

B. Limitations. Except upon written instructions of Owner, Owner's Project Representative shall not:

(1) Authorize any deviation from the Contract Documents or approve any substitute materials or equipment;

(2) Exceed limitations on Owner/Architect/Engineer's authority as set forth in the Contract Documents;

(3) Undertake any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent, or expedite the Work;

(4) Advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents;

(5) Advise on or issue directions as to safety precautions and programs in connection with the Work;

(6) Authorize Owner to occupy the project in whole or in part; or

(7) Participate in specialized field or laboratory tests.

ARTICLE VIII
RESOLUTION OF DISAGREEMENTS; CLAIMS FOR COMPENSATION

8.1 Owner to Decide Disputes. The Owner shall reasonably decide all questions and disputes (with the exception of matters pertaining to the interpretation of the Project Plans and Specifications which shall be resolved by the Architect/Engineer pursuant to Section 6.3) that may arise in the execution and fulfillment of the services provided for under the Contract Documents, in accordance with the Procurement Ordinance.

8.2 Finality. The decision of the Owner upon all claims, questions, disputes and conflicts shall be final and conclusive, and shall be binding upon all parties to the Contract Documents, subject to judicial review as provided in Section 8.5 below.

8.3 No Damages for Delay. If at any time Contractor is delayed in the performance of Contractor's responsibilities under the Contract Documents as the result of a default or failure to perform in a timely manner by Owner or Owner's agents or employees, Contractor shall not be entitled to any damages except for compensation specifically authorized in Article III. Contractor's sole remedy will be a right to extend the time for performance. Nothing herein shall preclude Contractor from any available remedy against any responsible party other than Owner.

Contractor shall be responsible for liquidated damages for delay if otherwise provided for in the Contract Documents.

8.4 Permitted Claims Procedure. Where authorized or permitted under the Contract Documents, all claims for additional compensation by Contractor, extensions of time affecting the Substantial Completion Date, for payment by the Owner of costs, damages or losses due to casualty, Force Majeure, Project Site conditions or otherwise, shall be governed by the following:

(1) All claims must be submitted as a request for Change Order in the manner as provided in Article V.

(2) The Contractor must submit a notice of claim to Owner's Project Representative and to the Architect/Engineer within fifteen (15) days of the beginning of such occurrence. Failure to submit a claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

(3) Within twenty (20) days of submitting its notice of claim, the Contractor shall submit to the Owner's Project Representative its request for Change Order, which shall include a written statement of all details of the claim, including a description of the Work affected.

(4) After receipt of a request for Change Order, the Owner's Project Representative, in consultation with the Architect/Engineer, shall deliver to the Contractor, within twenty (20) days after receipt of request, its written response to the claim.

(5) In the event the Owner and Contractor are unable to agree on the terms of a Change Order, the Owner shall have the option to instruct the Contractor to proceed with the Work. In that event, the Owner shall pay for those parts of the Work, the scope and price of which are not in dispute. The balance of the disputed items in the order to proceed will be resolved after completion of the Work, based upon completed actual cost.

(6) The rendering of a decision by Owner with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment) will be a condition precedent to any exercise by Owner or Contractor of such right or remedies as either may otherwise have under the Contract Documents or by laws or regulations in respect of any such claim, dispute or other matter.

8.5 Contract Claims and Disputes. After completion of the process set forth in Section 8.4 above, any unresolved dispute under this Agreement shall be decided by the Purchasing Official in accordance with Section 2-26-63 of the Manatee County Code of Laws, subject to an administrative hearing process as provided in Section 2-26-64. The decision of the hearing officer in accordance with Section 2-26-64 of the Manatee County Code of Laws shall be the final and conclusive decision subject to exclusive judicial review in circuit court by a petition for certiorari.

8.6 Claims for Consequential Damages. The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Agreement. This mutual waiver includes:

(1) damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons, unless any of such damages or losses are covered by insurance placed by the Contractor; and

(2) damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article XIV. Nothing contained in this Section 8.6 shall be deemed to preclude assessment of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

ARTICLE IX
INDEMNITY

9.1 Indemnity.

A. Indemnification Generally. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect/Engineer, Architect/Engineer's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.1.

B. Indemnification; Enforcement Actions. The Contractor's duty to indemnify and hold harmless the Owner in Section 9.1 above shall extend to fines, penalties and costs incurred by the Owner as related to any enforcement action taken by local, state, regional or federal regulatory entities. The Owner may deduct any of such fines, penalties and costs as described in this Section from any unpaid amounts then or thereafter due the Contractor under the Contract Documents. Any of such fines, penalties and costs not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at the maximum allowable rate.

C. Claims by Employees. In claims against any person or entity indemnified under this Section 9.1 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly

employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 9.1.A. shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

9.2 Duty to Defend. The Contractor shall defend the Owner in any action, lawsuit, mediation or arbitration arising from the alleged negligence, recklessness or intentionally wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of the Work. Notwithstanding any other provisions within this Article IX, so long as Contractor, through its own counsel, performs its obligation to defend the Owner pursuant to this Section, Contractor shall not be required to pay the Owner's costs associated with the Owner's participation in the defense.

ARTICLE X
ACCOUNTING RECORDS; OWNERSHIP OF DOCUMENTS

10.1 Accounting Records. Records of expenses pertaining to all services performed shall be kept in accordance with generally accepted accounting principles and procedures.

10.2 Inspection and Audit. The Contractor's records shall be open to inspection and subject to examination, audit, and/or reproduction during normal working hours by the Owner's agent or authorized representative to the extent necessary to adequately permit evaluation and verification of any invoices, payments or claims submitted by the Contractor or any of its payees during the performance of the Work. These records shall include, but not be limited to, accounting records, written policies and procedures, Subcontractor files (including proposals of successful and unsuccessful bidders), original estimates, estimating worksheets, correspondence, Change Order files (including documentation covering negotiated settlements), and any other supporting evidence necessary to substantiate charges related to the Contract Documents. They shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs (including overhead allocations) as they may apply to costs associated with the Contract Documents. For such audits, inspections, examinations and evaluations, the Owner's agent or authorized representative shall have access to said records from the effective date of the Contract Documents, for the duration of Work, and until three (3) years after the date of final payment by the Owner to the Contractor pursuant to the Contract Documents.

10.3 Access. The Owner's agent or authorized representative shall have access to the Contractor's facilities and all necessary records to conduct audits in compliance with this Article. The Owner's agent or authorized representative shall give the Contractor reasonable advance notice of intended inspections, examinations, and/or audits.

10.4 Ownership of Documents. Upon obtainment of Substantial Completion or termination of the Agreement, all records, documents, tracings, plans, specifications, maps, evaluations, reports, transcripts and other technical data, other than working papers, prepared or developed by the Contractor shall be delivered to and become the property of the Owner. The Contractor at its own expense may retain copies for its files and internal use.

ARTICLE XI
PUBLIC CONTRACT LAWS

11.1 Equal Opportunity Employment.

A. Employment. The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, sex, color, national origin, disability or age, and will take affirmative action to ensure that all employees and applicants are afforded equal employment opportunities without discrimination because of race, creed, sex, color, national origin, disability or age. Such action will be taken with reference to, but shall not be limited to, recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff or termination, rates of training or retraining, including apprenticeship and on-the-job training.

B. Participation. No person shall, on the grounds of race, creed, sex, color, national origin, disability or age, be excluded from participation in, be denied the proceeds of, or be subject to discrimination in the performance of the Agreement.

11.2 Immigration Reform and Control Act of 1986. Contractor acknowledges that it is responsible for complying with the provisions of the Immigration Reform and Control Act of 1986, located at 8 U.S.C. Section 1324, et seq., and regulations relating thereto. Failure to comply with the above statutory provisions shall be considered a material breach and shall be grounds for immediate termination of this Agreement.

11.3 No Conflict of Interest. The Contractor warrants that it has not employed or retained any company or person, other than a bona fide employee working solely for the Contractor to solicit or secure this Agreement, and that it has not paid or agreed to pay any person, company, corporation, individual, or firm other than a bona fide employee working solely for the Contractor, any fee, commission, percentage, gift or any other consideration, contingent upon or resulting from the award or making of this Agreement.

A. No Interest in Business Activity. By accepting award of this Agreement, the Contractor, which shall include its directors, officers and employees, represents that it presently has no interest in and shall acquire no interest in any business or activity which would conflict in any manner with the performance of services required hereunder, including without limitation as described in the Contractor's own professional ethical requirements. An interest in a business or activity which shall be deemed a conflict includes but is not limited to direct financial interest in any of the material and equipment manufacturers, suppliers, distributors, or contractors who will be eligible to supply material and equipment for the Project for which the Contractor is furnishing its services required hereunder.

B. No Appearance of Conflict. The Contractor shall not knowingly engage in any contractual or professional obligations that create an appearance of a conflict of interest with respect to the services provided pursuant to the Agreement. The Contractor has provided the Affidavit of No Conflict, incorporated into the Contract Documents as Exhibit "C", as a material inducement for Owner entering the Agreement. If, in the sole discretion of the County Administrator or designee, a conflict of interest is deemed to exist or arise during the term of this Agreement, the County Administrator or designee may cancel this Agreement, effective upon the date so stated in a written notice of cancellation, without penalty to the Owner.

11.4 Truth in Negotiations. By execution of the Contract Documents, the Contractor certifies to truth-in-negotiations and that wage rates and other factual unit costs supporting the compensation are accurate, complete and current at the time of contracting. Further, the original Contract Sum and any additions thereto shall be adjusted to exclude any significant sums where the Owner determines the Contract Sum was increased due to inaccurate, incomplete or non-current wage rates and other factual unit costs. Such adjustments must be made within one (1) year after final payment to the Contractor.

11.5 Public Entity Crimes. The Contractor is directed to the Florida Public Entity Crimes Act, Section 287.133, Florida Statutes, specifically section 2(a), and the Owner's requirement that the Contractor comply with it in all respects prior to and during the term of the Agreement.

ARTICLE XII
FORCE MAJEURE, FIRE OR OTHER CASUALTY

12.1 Force Majeure.

A. Unavoidable Delays. Delays in any performance by any party contemplated or required hereunder due to fire, flood, sinkhole, earthquake or hurricane, acts of God, unavailability of materials, equipment or fuel, war, declaration of hostilities, revolt, civil strife, altercation or commotion, strike, labor dispute, or epidemic, archaeological excavation, lack of or failure of transportation facilities, or any law, order, proclamation, regulation, or ordinance of any government or any subdivision thereof, or for any other similar cause to those enumerated, beyond the reasonable control and which with due diligence could not have been reasonably anticipated, shall be deemed to be events of Force Majeure and any such delays shall be excused. In the event such party is delayed in the performance of any Work or obligation pursuant to the Contract Documents for any of the events of Force Majeure stated in this Section 12.1, the date for performance required or contemplated by the Contract Documents shall be extended by the number of calendar days such party is actually delayed.

B. Concurrent Contractor Delays. If a delay is caused for any reason provided in Section 12.1.A.and during the same time period a delay is caused by Contractor, the date for performance shall be extended as provided in 12.1.A. but only to the extent the time is or was concurrent.

C. Notice; Mitigation. The party seeking excuse for nonperformance based on Force Majeure shall give written notice to the Owner, if with respect to the Contractor, or to the Contractor if with respect to the Owner, specifying its actual or anticipated duration. Each party seeking excuse from nonperformance based on Force Majeure shall use its best efforts to rectify any condition causing a delay and will cooperate with the other party, except that neither party shall be obligated to incur any unreasonable additional costs and expenses to overcome any loss of time that has resulted.

12.2 Casualty; Actions by Owner and Contractor. During the construction period, if the Project or any part thereof shall have been damaged or destroyed, in whole or in part, the Contractor shall promptly make proof of loss; and Owner and Contractor shall proceed promptly to collect, or cause to be collected, all valid claims which may have arisen against insurers or others based upon such damage or destruction. The Contractor shall diligently assess the damages or

destruction and shall prepare an estimate of the cost, expenses, and other charges, including normal and ordinary compensation to the Contractor, necessary for reconstruction of the Project substantially in accordance with the Project Plans and Specifications. Within fifteen (15) days following satisfaction of the express conditions described in subsections (1), (2) and (3) below, the Contractor covenants and agrees diligently to commence reconstruction and to complete the reconstruction or repair of any loss or damage by fire or other casualty to the Project to substantially the same size, floor area, cubic content, and general appearance as prior to such loss or damage:

(1) Receipt by the Owner or the trustee of the proceeds derived from collection of all valid claims against insurers or others based upon such damage or destruction, and receipt of other sums from any source such that the funds necessary to pay the Project Cost and any additions to the Project Cost necessitated for repair or reconstruction are available;

(2) Written agreement executed by the Contractor and the Owner, by amendment to the Contract Documents or otherwise, authorizing and approving the repair or reconstruction and any additions to the Project Cost necessitated thereby, including any required adjustment to the Contract Sum; and

(3) Final approval by the Owner of the Project Plans and Specifications for such repair or reconstruction and issuance of any required building permit.

12.3 Approval of Plans and Specifications. The Owner agrees to approve the plans and specifications for such reconstruction or repair if the reconstruction or repair contemplated by such plans and specifications is economically feasible, and will restore the Project, or the damaged portion thereof, to substantially the same condition as prior to such loss or damage, and such plans and specifications conform to the applicable laws, ordinances, codes, and regulations. The Owner agrees that all proceeds of any applicable insurance or other proceeds received by the Owner or the Contractor as a result of such loss or damage shall be used for payment of the costs, expenses, and other charges of the reconstruction or repair of the Project.

12.4 Notice of Loss or Damage. The Contractor shall promptly give the Owner written notice of any significant damage or destruction to the Project, defined as loss or damage which it is contemplated by Contractor will increase the Contract Sum or extend the Substantial Completion Date, stating the date on which such damage or destruction occurred, the then expectations of Contractor as to the effect of such damage or destruction on the use of the Project, and the then proposed schedule, if any, for repair or reconstruction of the Project. Loss or damage which the Contractor determines will not affect the Contract Sum or Substantial Completion Date will be reported to Owner and Architect/Engineer immediately, and associated corrective actions will be undertaken without delay.

ARTICLE XIII
REPRESENTATIONS, WARRANTIES AND COVENANTS

13.1 Representations and Warranties of Contractor. The Contractor represents and warrants to the Owner each of the following.

A. The Contractor is a construction company, organized under the laws of the State of _____, authorized to transact business in the State of Florida, with _____ as the primary qualifying agent. Contractor has all requisite power and authority to carry on its business as now conducted, to own or hold its properties, and to enter into and perform its obligations hereunder and under each instrument to which it is or will be a party, and is in good standing in the State of Florida.

B. Each Contract Document to which the Contractor is or will be a party constitutes, or when entered into will constitute, a legal, valid, and binding obligation of the Contractor enforceable against the Contractor in accordance with the terms thereof, except as such enforceability may be limited by applicable bankruptcy, insolvency, or similar laws from time to time in effect which affect creditors' rights generally and subject to usual equitable principles in the event that equitable remedies are involved.

C. There are no pending or, to the knowledge of the Contractor, threatened actions or proceedings before any court or administrative agency, within or without the State of Florida, against the Contractor or any partner, officer, or agent of the Contractor which question the validity of any document contemplated hereunder, or which are likely in any case, or in the aggregate, to materially adversely affect the consummation of the transactions contemplated hereunder, or materially adversely affect the financial condition of the Contractor.

D. The Contractor has filed or caused to be filed all federal, state, local, or foreign tax returns, if any, which were required to be filed by the Contractor, and has paid, or caused to be paid, all taxes shown to be due and payable on such returns or on any assessments levied against the Contractor.

E. Neither Contractor nor any agent or person employed or retained by Contractor has acted fraudulently or in bad faith or in violation of any statute or law in the procurement of this Agreement.

F. The Contractor shall timely fulfill or cause to be fulfilled all of the terms and conditions expressed herein which are within the control of the Contractor or which are the responsibility of the Contractor to fulfill. The Contractor shall be solely responsible for the means and methods of construction.

G. It is recognized that neither the Architect/Engineer, the Contractor, nor the Owner has control over the cost of labor, materials, or equipment, over a Subcontractor's methods of determining bid prices, or over competitive bidding, market, or negotiating conditions.

H. During the term of the Contract Documents, and the period of time that the obligations of the Contractor under the Contract Documents shall be in effect, the Contractor shall cause to occur and to continue to be in effect those instruments, documents, certificates, and events contemplated by the Contract Documents that are applicable to, and the responsibility of, the Contractor.

I. The Contractor shall assist and cooperate with the Owner and shall accomplish the construction of the Project in accordance with the Contract Documents and the Project Plans and Specifications, and will not knowingly violate any laws, ordinances, rules, regulations, or orders that are or will be applicable thereto.

J. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective, and that Owner, representatives of Owner, and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall give Architect/Engineer timely notice of readiness of the Work for all required approvals and shall assume full responsibility, including costs, in obtaining required tests, inspections, and approval certifications and/or acceptance, unless otherwise stated by Owner.

K. If any Work (including Work of others) that is to be inspected, tested, or approved is covered without written concurrence of Architect/Engineer, it must, if requested by Architect/Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Architect/Engineer timely notice of Contractor's intention to cover the same and Architect/Engineer has not acted with reasonable promptness in response to such notice. Neither observations by Architect/Engineer nor inspections, tests, or approvals by others shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

L. If the Work is defective, or Contractor fails to supply sufficient skilled workers, or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof and terminate payments to the Contractor until the cause for such order has been eliminated. Contractor shall bear all direct, indirect and consequential costs for satisfactory reconstruction or removal and replacement with non-defective Work, including, but not limited to fees and charges of Architect/Engineers, attorneys and other professionals and any additional expenses experienced by Owner due to delays to other Contractors performing additional Work and an appropriate deductive change order shall be issued. Contractor shall further bear the responsibility for maintaining the schedule and shall not be entitled to an extension of the Contract Time or the recovery of delay damages due to correcting or removing defective Work.

M. If Contractor fails within seven (7) days after written notice to correct defective Work, or fails to perform the Work in accordance with the Contract Documents, or fails to comply with any other provision of the Contract Documents, Owner may correct and remedy any such deficiency to the extent necessary to complete corrective and remedial action. Owner may temporarily exclude Contractor from all or part of the site, temporarily take possession of all or part of the Work, Contractor's tools, construction equipment and machinery at the site or for which Owner has paid Contractor but which are stored elsewhere, all for such duration as is reasonably necessary to correct the deficiency. All direct and indirect costs of Owner in exercising such rights and remedies will be charged against Contractor in an amount approved as to reasonableness by Architect/Engineer and a Change Order will be issued incorporating the necessary revisions.

N. If within three (3) years after the Substantial Completion Date or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner’s written instructions, either correct such defective Work or if it has been rejected by Owner, remove it from the site and replace it with non-defective Work. If Contractor does not promptly comply with the

terms of such instruction, Owner may have the defective Work corrected/removed and all direct, indirect and consequential costs of such removal and replacement will be paid by Contractor. Failing payment by the Contractor and notwithstanding any other provisions of the Contract Documents to the contrary, Owner shall have the right to bring a direct action in the Circuit Court to recover such costs.

13.2 Representations of the Owner. To the extent permitted by law, the Owner represents to the Contractor that each of the following statements is presently true and accurate:

A. The Owner is a validly existing political subdivision of the State of Florida.

B. The Owner has all requisite corporate or governmental power and authority to carry on its business as now conducted and to perform its obligations under the Contract Documents and each Contract Document contemplated hereunder to which it is or will be a party.

C. The Contract Documents and each Contract Document contemplated hereby to which the Owner is or will be a party has been duly authorized by all necessary action on the part of, and has been or will be duly executed and delivered by, the Owner, and neither the execution and delivery thereof nor compliance with the terms and provisions thereof or hereof: (a) requires the approval and consent of any other person or party, except such as have been duly obtained or as are specifically noted herein; (b) contravenes any existing law, judgment, governmental rule, regulation or order applicable to or binding on the Owner; or (c) contravenes or results in any breach of, default under, or result in the creation of any lien or encumbrance upon the Owner under any indenture, mortgage, deed of trust, bank loan, or credit agreement, the charter, ordinances, resolutions, or any other agreement or instrument to which the Owner is a party, specifically including any covenants of any bonds, notes, or other forms of indebtedness of the Owner outstanding on the date of the Contract Documents.

D. The Contract Documents and each document contemplated hereby to which the Owner is or will be a party constitutes, or when entered into will constitute, a legal, valid, and binding obligation of the Owner enforceable against the Owner in accordance with the terms thereof, except as such enforceability may be limited by applicable bankruptcy, insolvency, or similar laws from time to time in effect which affect creditors' rights generally, and subject to usual equitable principles in the event that equitable remedies are involved.

E. There are no pending or, to the knowledge of the Owner, threatened actions or proceedings before any court or administrative agency against the Owner which question the validity of the Contract Documents or any document contemplated hereunder, or which are likely in any case or in the aggregate to materially adversely affect the consummation of the transactions contemplated hereunder or the financial or corporate condition of the Owner.

F. The Owner shall use due diligence to timely fulfill or cause to be fulfilled all of the conditions expressed in the Contract Documents which are within the control of the Owner or which are the responsibility of the Owner to fulfill.

G. During the pendency of the Work and while the obligations of the Owner under the Contract Documents shall be in effect, the Owner shall cause to occur and to continue to be in effect and take such action as may be necessary to enforce those instruments, documents,

certificates and events contemplated by the Contract Documents that are applicable to and the responsibility of the Owner.

H. The Owner shall assist and cooperate with the Contractor in accomplishing the construction of the Project in accordance with the Contract Documents and the Project Plans and Specifications, and will not knowingly violate any laws, ordinances, rules, regulations, orders, contracts, or agreements that are or will be applicable thereto or, to the extent permitted by law, enact or adopt any resolution, rule, regulation, or order, or approve or enter into any contract or agreement, including issuing any bonds, notes, or other forms of indebtedness, that will result in the Contract Documents or any part thereof, or any other instrument contemplated by and material to the timely and effective performance of a party's obligations hereunder, to be in violation thereof.

ARTICLE XIV
TERMINATION AND SUSPENSION

14.1 Termination for Cause by Owner. This Agreement may be terminated by Owner upon written notice to the Contractor should Contractor fail substantially to perform a material obligation in accordance with the terms of the Contract Documents through no fault of the Owner. In the event Owner terminates for cause and it is later determined by a court of competent jurisdiction that such termination for cause was not justified, then in such event such termination for cause shall automatically be converted to a termination without cause pursuant to Section 14.2.

A. Nonperformance. If the Contractor fails to timely perform any of its obligations under the Contract Documents, including any obligation the Contractor assumes to perform Work with its own forces, or if it persistently or repeatedly refuses or fails, except in case for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or fails, without being excused, to maintain an established schedule (failure to maintain schedule shall be defined as any activity that falls thirty (30) days or more behind schedule) which has been adopted by the Construction Team, or it fails to make prompt payment to Subcontractors for materials or labor, or disregards laws, rules, ordinances, regulations, or orders of any public authority having jurisdiction, or otherwise is guilty of substantial violations of the Agreement the Owner may, after seven (7) days written notice, during which period the Contractor fails to perform such obligation, make good such deficiencies and perform such actions. The Contract Sum shall be reduced by the cost to the Owner of making good such deficiencies, and the Contractor's compensation shall be reduced by an amount required to manage the making good of such deficiencies. Provided, however, nothing contained herein shall limit or preclude Owner from pursuing additional damages from Contractor because of its breach.

B. Insolvency. If the Contractor is adjudged bankrupt, or if it makes a general assignment for the benefit of its creditors, or if a receiver is appointed because its insolvency, then the Owner may, without prejudice to any other right or remedy, and after giving the Contractor and its surety, if any, fourteen (14) days written notice, and during which period the Contractor fails to cure the violation, terminate the Agreement. In such case, the Contractor shall not be entitled to receive any further payment. Owner shall be entitled to recover all costs and damages arising because of failure of Contractor to perform as provided in the Contract Documents, as well as reasonable termination expenses, and costs and damages incurred by the Owner may be deducted from any payments left owing the Contractor.

C. Illegality. Owner may terminate the Agreement if Contractor disregards laws or regulations of any public body having jurisdiction.

D. Rights of Owner. The Owner may, after giving Contractor (and the surety, if there is one) seven (7) days written notice, terminate the services of Contractor for cause; exclude Contractor from the Project Site and take possession of the Work and of all Contractor's tools, construction equipment and machinery at the Project Site and use the same to the full extent they could be used (without liability to Contractor for trespass or conversion); incorporate in the Work all materials and equipment stored at the Project Site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case, Contractor shall not be entitled to receive any further payment beyond an amount equal to the value of material and equipment not incorporated in the Work, but delivered and suitably stored, less the aggregate of payments previously made. If the direct and indirect costs of completing the Work exceed the unpaid balance of the Contract Sum, Contractor shall pay the difference to Owner. Such costs incurred by Owner shall be verified by Owner in writing; but in finishing the Work, Owner shall not be required to obtain the lowest quote for the Work performed. Contractor's obligations to pay the difference between such costs and such unpaid balance shall survive termination of the Agreement. In such event and notwithstanding any other provisions of the Contract Documents to the contrary, Owner shall be entitled to bring a direct action in the Circuit Court to recover such costs.

14.2 Termination without Cause by Owner. The Owner, through its County Administrator or designee, shall have the right to terminate the Agreement, in whole or in part, without cause upon sixty (60) calendar days' written notice to the Contractor. In the event of such termination for convenience, the Owner shall compensate Contractor for payments due through the date of termination, and one subsequent payment to cover costs of Work performed through the date of termination, subject to the terms and conditions of Section 3.1. The Contractor shall not be entitled to any other further recovery against the Owner, including, but not limited to, anticipated fees or profit on Work not required to be performed, or consequential damages or costs resulting from such termination.

A. Release of Contractor. As a condition of Owner's termination rights provided for in this subsection, Contractor shall be released and discharged from all obligations arising by, through, or under the terms of the Contract Documents, and the Payment and Performance Bond shall be released. Owner shall assume and become responsible for the reasonable value of Work performed by Subcontractors prior to termination plus reasonable direct close-out costs, but in no event shall Subcontractors be entitled to unabsorbed overhead, anticipatory profits, or damages for early termination.

B. Waiver of Protest. Contractor hereby waives any right to protest the exercise by Owner of its rights under this Section that may apply under the Procurement Ordinance.

14.3 Suspension without Cause. Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety (90) days by written notice to Contractor, which will fix the date on which Work will be resumed. Contractor shall be allowed an increase in the Contract Sum or an extension of the Contract Time, or both, directly attributable to any suspension if Contractor makes an approved claim therefor.

14.4 Termination Based Upon Abandonment, Casualty or Force Majeure. If, after the construction commencement date (i) Contractor abandons the Project (which for purposes of this paragraph shall mean the cessation of all construction and other activities relating to the Project, excluding those which are necessary to wind down or otherwise terminate all outstanding obligations with respect to the Project, and no recommencement of same within one hundred twenty (120) days following the date of cessation), or (ii) the Project is stopped for a period of thirty (30) consecutive days due to an instance of Force Majeure or the result of a casualty resulting in a loss that cannot be corrected or restored within one hundred twenty (120) days (excluding the time required to assess the damage and complete the steps contemplated under Section 12.2), the Owner shall have the right to terminate the Agreement and pay the Contractor its compensation earned or accrued to date.

14.5 Vacation of Project Site; Delivery of Documents. Upon termination by Owner pursuant to Section 14.2 or 14.4, Contractor shall withdraw its employees and its equipment, if any, from the Project Site on the effective date of the termination as specified in the notice of termination (which effective date shall not be less than two (2) working days after the date of delivery of the notice), regardless of any claim the Contractor may or may not have against the Owner. Upon termination, the Contractor shall deliver to the Owner all original papers, records, documents, drawings, models and other material set forth and described in the Contract Documents.

14.6 Termination by the Contractor. If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety (90) consecutive days by Owner or under an order of court or other public authority, or Owner fails to act on any Application for Payment or fails to pay Contractor any sum finally determined to be due; then Contractor may, upon fourteen (14) days written notice to Owner terminate the Agreement and recover from Owner payment for all Work executed, any expense sustained plus reasonable termination expenses. In lieu of terminating the Agreement, if Owner has failed to act on any Application for Payment or Owner has failed to make any payment as aforesaid, Contractor may upon fourteen (14) days written notice to Owner stop the Work until payment of all amounts then due.

(Remainder of this page intentionally left blank)

Exhibit A
Title(s) of Drawings

Exhibit B
Title(s) of Specifications

Exhibit C
Affidavit of No Conflict

Exhibit D
Contractor's Certificate(s) of Insurance

Exhibit E
Contractor's Payment and Performance Bond

Exhibit F
Standard Forms

APPLICATION FOR PAYMENT

Request No.: ____ Project No.: _____
Purchase Order No.: _____
Project: _____ County Bid No.: _____
From: _____ To: _____ Consultant: _____

CONTRACT PAYMENT SUMMARY

Original Contract Amount:				$ -
Change Order(s):				$ -
Change order summary:				
Number	Date Approved	Additive	Deductive	
SUBTOTALS:		$ -	$ -	
Net change order subtotal (Additive less Deductive):				$ -
Current Contract Amount (CCA): (Original Amount + Change Order(s))				$ -
		Previous Status	Total WIP	
Value of the Work in Place (WIP)		$ -	$ -	
Value of Stored Materials		$ -	$ -	
Total Earned ($ and % of CCA)		$ -	$ -	
Retainage ($ and % of CCA)		$ -	$ -	
Net Earned (Total earned minus retainage)				$ -
TOTAL PREVIOUS PAYMENTS				$ -
AMOUNT DUE THIS PAYMENT (Net Earned minus Previous Payments)				$ -

CONTRACTOR'S AFFIDAVIT OF NOTICE

CERTIFICATE: The undersigned CONTRACTOR certifies that all items and amounts shown on this Application for Payment are on account of work performed, materials supplied and/or materials stored on site and paid for by Contractor in accordance with the Contract Documents with due consideration for previous Payment(s), if any, received by the Contractor from the County, and that the Amount Due this Payment shown is now due.

NOTARY:

State of Florida, County of _____

Sworn to (or affirmed) and subscribed before me this _____ day of _____ by

_____
(Name of person giving notice)

_____
(Signature of Notary Public - State of Florida)
Print, Type or Stamp Commissioned Name of Notary Public:

Personally Known ____ or Produced Identification ____
Type of Identification Produced: _____

CONTRACTOR:

_____
Name of person authorized to sign Affidavit of Notice

_____
TITLE

Contractor name, address and telephone no.:

_____
_____
_____
_____
_____

VERIFICATION, RECOMMENDATION, CONCURRENCES AND APPROVALS

	(Signatures)	(Date)
Quantities verified by:		
Consultant/Engineer:		
Project Management:		
Department Head:		
Payment approved by the Board of County Commissioners:		
Attested to by the Clerk of Circuit Court:		

CERTIFICATE OF SUBSTANTIAL COMPLETION (S.C.)	CHECK ONE:	
	Partial	Total
Project Title:	Date Submitted:	
Contractor Data: Name: Address: City/State/Zip:	Project No: S. C. Date (Proposed)	

If the "Partial" completion box above is checked, the following description applies to the work for which substantial completion is being sought. Otherwise, the work described in the Contract including approved changes, if any, is certified to be substantially complete:
(Description of the portion of work substantially completed):

(USE CONTINUATION SHEETS IF NECESSARY)

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item does not alter the Contractor's responsibility to complete all of the contract work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by the Contractor within _____ days of substantial completion. The approved substantial completion date is: _____

Contractor Signature	Date	Engineer's Approval	Date
Printed Name and Title		Printed Name and Title	

The Contractor shall be responsible for security, operation, safety, maintenance, HVAC, insurance and warranties in accordance with the Contract. The County will assume the responsibility for paying the cost of electrical power from midnight of the date of Engineer's approval as indicated above.

ATTACH THE INSPECTOR'S FINAL WALKTHROUGH LIST OF DEFICIENCIES.

FINAL RECONCILIATION, WARRANTY PERIOD DECLARATION AND CONTRACTOR'S AFFIDAVIT

Project Title:	Date Submitted:
Contractor Data: Name: Address: City/State/Zip:	Project No: Warranty (months):

This Final Reconciliation is for the work performed for Manatee County by the above named contractor, hereinafter called CONTRACTOR, pursuant to the contract dated _____ as amended, and acts as an addendum thereto.

It is agreed that all quantities and prices in the attached Final Pay Estimate No. _____ are correct and that the amount of $_____ including retainage is due to the CONTRACTOR, that no claims are outstanding as between the parties, and that the above stated sum represents the entirety of monies owed the CONTRACTOR.

It is further agreed that the warranty period for CONTRACTOR'S work pursuant to the Contract is from _____ to _____

As (title) _____ for CONTRACTOR, I have authority to bind said CONTRACTOR, and as such make this final reconciliation, declaration and affidavit for the purpose of inducing Manatee County to make final payment to CONTRACTOR for work done at/upon _____ under said contract:

CONTRACTOR has paid all social security and withholding taxes accrued in connection with the construction project.

CONTRACTOR has paid all workers' compensation and other insurance premiums incurred in connection with this construction project.

CONTRACTOR has paid for all required permits in connection with this construction project.

All laborers, material, men, suppliers, subcontractors and service professionals who worked for and/or supplied materials, equipment and/or services to the CONTRACTOR under this construction contract have been paid in full.

_____
(Affiant Signature)

NOTARY:
State of Florida, County of _____ , Sworn to (or affirmed) and subscribed before me this _____ day of _____ , ____, by _____ (person giving notice).

Signature of Notary Public - State of Florida: _____
Print, Type or Stamp Commissioned Name of Notary Public:

Personally Known ☐ or Produced Identification ☐
Type of Identification Produced _____

CONTRACT CHANGE ORDER

(for Total Contract Adjusted Amount Greater than $1,000,000)

PROJECT:

Change Order No.:

Contract Amount (Present Value)

Project Number:

NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	BY EXECUTION OF THIS CHANGE ORDER THE CONTRACTOR AGREES THAT ALL CLAIMS FOR ADDITIONAL CONTRACT TIME AND FEES FOR THE ITEMS IN THIS CHANGE ORDER HAVE BEEN SATISFIED.		
		TOTAL DECREASE:	**TOTAL INCREASE:**

Contractor: _____
Address: _____
City / State: _____

Contractor Signature: _____ Date: _____

THE NET CHANGE OF

ADJUSTS THE CURRENT CONTRACT AMOUNT FROM

TO

____ CALENDAR DAYS ARE ADDED TO THE SCHEDULE WHICH CHANGES THE FINAL COMPLETION DATE TO

MONTH DAY, YEAR

RECOMMENDATION, CONCURRENCES AND APPROVALS

	SIGNATURES	DATE
Consultant / Engineer:		
Project Manager:		
Division Manager:	**Project Management Division Manager**	
Manatee County Purchasing:	**Purchasing Official**	

Authority to execute this contract per Manatee County Code, Chapter 2-26, and per the delegation by the County Administrator effective 1/26/2009

JUSTIFICATION FOR CHANGE	Change Order No : Project Number:

1. NECESSITY FOR CHANGE:

2. Is change an alternate bid? (If yes, explain)

3. Does change substantially alter the physical size of the project? (If yes, explain)

4 Effect of this change on other "Prime" contractors?

5 Has the Surety and insurance company been notified, if applicable? CONTRACTOR RESPONSIBILITY