

 *Technical Specifications*

*Bid Set*

# **SOUTH COUNTY WASTEWATER TREATMENT FACILITY (SWWTF) REUSE CONTROL PANEL REPLACEMENT**

*Prepared For:*  
Indian River County Utilities

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**SECTION 01000**

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**NO SPECIFICATIONS ON THIS PAGE FOR FORMATTING PURPOSES**

**SECTION 01010**  
**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.1 WORK COVERED BY THESE CONTRACT DOCUMENTS**

- A. Furnish all labor, equipment and materials necessary to construct all improvement elements at the South County Wastewater Treatment Facility described in the plans and these specifications:
  - 1. Demolition of existing Reuse Control Panel (RCP); construction of three (3) Variable Frequency Drives (VFDs) for the reuse pump station pumps; and replacement of three (3) existing reuse pump station pump motors with new 100-hp, TEFC, inverter duty rated motors; construction of instrumentation, and all other wiring, labor, materials to provide a fully functional system.
  - 2. Sequence of work is provided to minimize WWTP shutdowns and provide emergency standby power throughout duration of construction.
  - 3. Except as specifically noted, provide and pay for:
    - a. Mobilization and demobilization.
    - b. Labor, materials, and equipment.
    - c. Tools, construction equipment, and fuel.
    - d. Electric, water and utilities required for construction.
    - e. Freight and sales tax.
    - f. Record Information in electronic form (both AutoCAD and PDF) and a hardcopy. Information will be used by the Engineer for Record Drawing development.
- B. The Contractor shall include in their bid, as a lump sum, the work necessary to perform the programming and integration for the proposed improvements. The Contractor utilize the services of Control Systems Design, Inc. to perform the programming for this project. Contact information for Control Systems Design, Inc. is as follows; P: (941) 907-8815; e-mail: mb.csdinc@gmail.com. The instrumentation and controls (I&C) supplier will coordinate as necessary with the programmer, and shall supply, install, and test the complete instrumentation including 5-point calibration on all instruments with completed calibration sheets.

**1.2 CONTRACTS**

- A. Construct the Work under a Lump Sum Price contract in accordance with the contract documents and with the Owner.
- B. Subcontractors (when used) shall work directly for the contractor.

**1.3 WORK BY OTHERS AND FUTURE WORK**

- A. The Owner reserves the right to add to the work in accordance with the Contract Documents.
- B. The Owner reserves the right to direct purchase significant pieces of equipment and/or materials included in this contract by means of a deductive Change Order to this Contract and issuance of a Purchase Order to the supplier or vendor of the equipment or materials for the purpose of the sales tax end use savings.

#### **1.4 WORK SEQUENCE**

Proposed improvements shall be phased to allow for two (2) of the three (3) pumps to remain in service throughout the duration of the project. Recommended sequence of work is provided in the electrical sheets of the contract drawings.

#### **1.5 CONTRACTOR-FURNISHED PRODUCTS AND RESPONSIBILITIES**

- A. Products furnished to the site and paid for by Contractor: All products necessary to complete the work described herein these contract documents and specifications to provide a complete and functional system.
- B. Contractor's Responsibilities:
  - 1. Review and incorporate Owner-reviewed shop drawings, product data, and samples into the construction of the project.
  - 2. Schedule with the Owner and attend plant site safety training provided by wastewater plant staff. All contractor and subcontractor staff that are working on site are required to attend the training.
  - 3. Provide any items determined by the Owner to be salvaged to the Owner's on-site staging area.
  - 4. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 5. Repair or replace items damaged after receipt.
  - 6. Arrange and pay for product delivery to site.
  - 7. Handle, store, protect and install all delivered products.
  - 8. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 9. Arrange for manufacturers' warranties, inspections, and service.
  - 10. Provide the Owner with a one-year warranty on all equipment and workmanship from the date of substantial completion.
  - 11. Obtain any permits that may be required to execute the project.

#### **1.6 CONTRACTOR'S USE OF THE PREMISES**

- A. All work shall be within the limits of the County owned wastewater treatment plant facility. Contractor shall be responsible for maintenance of traffic when working within the public rights of way.
- B. The Contractor shall coordinate with the County for material lay down and equipment storage areas on site. The contractor shall maintain access to County facilities at all times and not interfere with the operations of other contractors who may also be working within the facility. Any damage caused by the contractor within staging areas shall be completely restored by the contractor to the Owner's satisfaction at no additional cost to the Owner.
- C. All Contractor and subcontractor workers and laborers shall be required to wear clothing that identifies them with their respective contractors. All workers and laborers shall remain in their designated work areas and at no time shall be wandering the site.

#### **1.7 PERMITS REQUIRED**

- A. Contractor shall submit all necessary building and electrical permit applications for the proposed improvements. Contractor shall pay the permit application fee and obtain the permit.
- B. No FDEP permit is required as part of the proposed work.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

- END OF SECTION -

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**SECTION 01030**  
HURRICANE PREPAREDNESS

**PART 1 - GENERAL**

**1.1 HURRICANE PREPAREDNESS PLAN**

- A. The Contractor's attention is drawn to the possibility of hurricane or severe storm conditions occurring at the site of work during the course of Contract Work.
- B. Within fourteen (14) days of the date of the Notice to Proceed, the Contractor shall submit to the Engineer and Owner a Hurricane Preparedness Plan specific to this project. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane or severe weather warning.
- C. In the event of inclement weather, or whenever the Owner shall direct, the Contractor shall, and will, cause Subcontractors to protect carefully the Work and materials against damage or injury. Work and materials damaged due to inclement weather shall be removed and replaced at the expense of the Contractor.
  - 1. Hurricane Watch: Upon designation of a hurricane watch, the Contractor shall be responsible for storing all loose supplies and strapping down or removing large materials and equipment on the job site that may pose a danger. In addition, the Contractor shall remove all bulkheads and plugs in pipelines that would impede drainage in the case of flooding. Structures that may be in danger of floatation shall be flooded. The Contractor shall also cooperate with the Owner in protecting any other structures at the site.
  - 2. Hurricane Warning: No mobile "temporary facility" under the control of or on the property of the Owner shall be staffed during a hurricane warning. Contractor facilities meeting these criteria shall be evacuated. Reasonable steps shall be taken to protect all such facilities and their contents from damage and to avoid the facility causing damage to the surroundings.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

- END OF SECTION -

**NO SPECIFICATIONS ON THIS PAGE FOR FORMATTING PURPOSES.**

## **SECTION 01300**

### **SUBMITTALS**

#### **PART 1 - GENERAL**

##### **1.1 WORK INCLUDED**

- A. Contractor shall submit to the Engineer, shop drawings, project data and samples required by specification sections.

##### **1.2 SCHEDULES**

- A. Prepare and submit a Construction Schedule.
- B. Prepare and submit a separate schedule listing dates for submission of shop drawings and projected return dates.
- C. Schedules shall be updated and re-submitted on a monthly basis throughout the duration of the project.
- D. Prepare and submit two-week look ahead schedules bi-weekly throughout duration of the project.
- E. Coordinate all work with OWNER operations staff. Construction activities that impact operations require 48 hours advance notice and approval from the OWNER. No WWTP shutdowns will be permitted as part of this project.

#### **PART 2 - PRODUCTS**

##### **2.1 SHOP DRAWINGS**

- A. Original drawings, prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate portions of the Work; showing fabrication, layout, setting or erection details including, but not limited to the following:
  - 1. Construction phasing plan
  - 2. Variable frequency drives
  - 3. Motor control center buckets
  - 4. Electric motors
  - 5. Electrical Panels
  - 6. Electrical conductors
  - 7. Electrical conduit
  - 8. Miscellaneous metals
- B. Prepare submittals by a qualified detailer.
- C. Identify details by reference to sheet numbers and detail shown on Contract Drawings.

##### **2.2 PROJECT DATA**

- A. Manufacturer's standard schematic drawings:
  - 1. Modify drawings to delete information which is not applicable to project.
  - 2. Supplement standard information to provide additional information applicable to project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.

1. Clearly mark each copy to identify pertinent materials, products or models.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.
4. Show wiring diagrams and controls.

### **2.3 SAMPLES**

- A. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.
- B. Office samples of sufficient size and quantity to clearly illustrate:
  1. Functional characteristics of product or material, with integrally related parts and attachment devices.
  2. Full range of color samples.

### **2.4 PAY REQUESTS**

- A. Pay Requests shall be made in accordance with the requirements of the Agreement between Owner and Contractor. Payment requests shall include updated schedules as required in required 01300-1.2.

## **PART 3 - EXECUTION**

### **3.1 SUBMISSION REQUIREMENTS**

- A. Schedule submissions at least 14 days before dates reviewed submittals will be needed.
- B. Submit number of copies of Shop Drawings, Project Datum and Samples which Contractor requires for distribution plus 4 copies for the Owner and Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  1. Date.
  2. Project title and number.
  3. Contractor's name and address.
  4. Notification of deviations from Contract Documents.
  5. Other pertinent data.
- D. Submittals must include:
  1. Date of submittal and revision dates.
  2. Project title and number.
  3. The names of:
    - a. Engineer.
    - b. Contractor.
    - c. Subcontractor.
    - d. Supplier.
    - e. Manufacturer.
    - f. Separate detailer when pertinent.
  4. Identification of product or material.
  5. Relation to adjacent structure or materials.
  6. Field dimensions, clearly identified as such.
  7. Identification of deviations from Contract Documents.

8. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents.

### **3.2 RESUBMISSION REQUIREMENTS**

- A. Shop Drawings:
  1. Revise initial drawings as required and resubmit as specified for initial submittal.
  2. Clearly indicate on shop drawings all changes or revisions which have been made other than those requested by Engineer.
  3. Re-submittals without all comments from original review addressed will be returned to the contractor.
- B. Project Data and Samples:
  1. Submit new datum and samples as required for initial submittal.

### **3.3 DISTRIBUTION OF SUBMITTALS AFTER REVIEW**

- A. Distribute copies of Shop Drawings and Project Datum which carry Engineer's stamp, to:
  1. Contractor's file.
  2. Job site file.
  3. Record Documents file.
  4. Other prime contractors.
  5. Subcontractors.
  6. Supplier.
  7. Fabricator.
- B. Distribute samples as directed.

**- END OF SECTION -**

**NO SPECIFICATIONS ON THIS PAGE FOR FORMATTING PURPOSES.**

**SECTION 01700**  
**PROJECT CLOSEOUT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Comply with requirements stated in the Agreement between Owner and Contractor and in Specifications for administrative procedures in closing out the Work.

**1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE**

- A. Section 01720 - Project Record Drawings
- B. Section 01730 – Operating and Maintenance Manuals

**1.3 SUBSTANTIAL COMPLETION**

- A. Substantial completion shall be defined as beneficial use of all proposed equipment. Beneficial use will not occur until all VFDs, MCC buckets, electric motors, pull boxes, conduit, wiring, etc., have been installed, programmed, functionally tested, and accepted by the Owner and Engineer of record.
- B. The Contractor shall deliver to the Engineer the Record Drawings and a draft copy of the Operations and Maintenance manuals for review and deliver to the Owner a complete set of all spare parts.
- C. When Contractor considers the Work is substantially complete, Contractor shall submit to Engineer:
  - 1. A written notice that the Work or designated portion thereof, is substantially complete.
- D. Within a reasonable time after receipt of such notice, Engineer will perform a field investigation to determine the status of completion.
- E. Should Engineer determine that the Work is not substantially complete:
  - 1. Engineer will promptly notify the Contractor in writing, giving the reasons therefore.
  - 2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Engineer.
  - 3. Engineer will reinvestigate the Work.
- F. When the Engineer finds that the Work is substantially complete, he will:
  - 1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion, with a tentative list of items to be completed or corrected before final payment.
  - 2. After consideration of any objections made by the Owner and when Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

**1.4 FINAL SITE REVIEWS**

- A. When Contractor considers Work is complete, he shall submit written certification that:
  - 1. Contract Documents have been reviewed.
  - 2. Work has been investigated for compliance with Contract Documents.
  - 3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
5. Work is completed and ready for Final Investigation.
- B. Engineer will perform a field investigation to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Engineer consider that the Work is incomplete or defective:
  1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
  2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to Engineer that the Work is complete.
  3. Engineer will reinvestigate the Work.
- D. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

#### **1.5 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER**

- A. Project Record Drawings to the requirements specified.
- B. Operating and Maintenance Manuals to the requirements specified.
- C. Contractor's affidavit of payment of debts and claims.
  1. Contractor's release or waiver of liens.
- D. Separate releases or waivers of liens for subcontractors, suppliers and others with lien rights against property of Owner, together with list of those parties.

#### **1.6 FINAL ADJUSTMENTS OF ACCOUNTS**

- A. Submit a final statement of accounting to Engineer.
- 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. Allowances.
    - c. Unit Prices.
    - d. Deductions for uncorrected Work.
    - e. Deductions for liquidated damages.
    - f. Deductions for re-inspection payments.
    - g. Other adjustments.
  3. Total Contract Sum, as adjusted.
  4. Previous payments.
  5. Sum remaining due.
- C. Engineer will prepare a final Change Order reflecting approved adjustments to the Contract Sum which was not previously made by Change Orders.

#### **1.7 FINAL APPLICATION FOR PAYMENT**

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Condition of the Contract.



**1.8 FINAL CERTIFICATE FOR PAYMENT**

- A. Engineer will issue final certificate in accordance with provisions of the Contract Documents.

**1.9 POST-CONSTRUCTION INSPECTION**

- A. Prior to expiration of one year from Date of Substantial Completion, Engineer will make visual field investigation of Project in company with Owner and Contractor to determine whether correction of Work is required, in accordance with provisions of the Contract Documents.
- B. For Guarantees beyond one year, Engineer will make field investigations at request of Owner, after notification to Contractor.
- C. Engineer will promptly notify Contractor, in writing, of any observed deficiencies.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

**- END OF SECTION -**

**NO SPECIFICATIONS ON THIS PAGE FOR FORMATTING PURPOSES.**

**SECTION 01720**  
**PROJECT RECORD DRAWINGS**

**PART 1 - GENERAL**

**1.1 PROJECT RECORD DOCUMENTS**

- A. Maintain at the site for the Owner one record copy of:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other Modifications to the Contract.
  - 5. Engineer Field Orders or written instructions.
  - 6. Reviewed Shop Drawings.
  - 7. Field test records.

**1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE**

- A. Conditions of the Contracts
- B. Section 01700 – Project closeout

**1.3 MAINTENANCE OF DOCUMENTS**

- A. Store documents in approved location apart from documents used for construction.
- B. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- C. Make documents available at all times for inspection by Engineer and Owner. Record drawing information shall be maintained concurrently with Pay Requests and updated project schedules.

**1.4 MARKING DEVICES**

- A. Provide ink marking pens for recording information in a color code.

**1.5 RECORDING**

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information currently with construction progress.
  - 1. Do not conceal any work until required information is recorded.
- C. Drawings shall be drawn to record actual construction:
  - 1. Field changes of dimension and detail.
  - 2. Changes made by Field Order or by Change Order.
  - 3. Details not on original Contract Drawings.
- D. Specifications and Addenda; Legibly mark each Section to record:
  - 1. Manufacturer, trade name, catalog number, and supplier of each item actually installed.
  - 2. Changes made by Field Order or by Change Order.

**1.6 SUBMITTAL**

- A. At Contract Close-out, Record Documents shall be submitted to Engineer in the following formats for Owner:
  - 1. One set on 24" x 36".

- B. Accompany submittal with transmittal letter in duplicate, 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.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

Not used.

- END OF SECTION -

**SECTION 01730**  
OPERATION AND MAINTENANCE MANUALS

**PART 1 - GENERAL**

**1.1 RELATED INFORMATION**

- A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
  - 1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
- B. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.
- C. Related Requirements Specified in Other Sections.
  - 1. Section 01300 - Submittals
  - 2. Section 01720 - Project Record Drawings
  - 3. Section 16480 – Motor Control Centers
  - 4. Section 16681 – Variable Frequency Drives
  - 5. Section 16690 – Electric Motors
  - 6. Section 16901 – I&C Systems

**1.2 FORM OF SUBMITTALS**

- A. Prepare data in the form of an instructional manual and electronic format for use by Owner's personnel.
- B. Hard-Copy Format:
  - 1. Size: 8-1/2 in. x 11 in.
  - 2. Text: Manufacturer's printed data, or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punch binder tab, bind in with text.
    - b. Fold larger drawings to the size of the text pages.
  - 4. 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.
  - 5. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
    - a. Title of Project.
    - b. Identity of separate structure as applicable.
    - c. Identity of general subject matter covered in the manual.
- C. Binders:
  - 1. Commercial quality expandable catalog binders with durable and cleanable plastic covers.
  - 2. When multiple binders are used, correlate the data into related consistent groupings.
- D. Electronic format shall be in .pdf file format. Copies of specific manuals shall either be scanned or converted to .pdf format and submitted on CD disc to Owner. Submit after approval of hard copies from Engineer.

### 1.3 CONTENT OF MANUAL

- A. Neatly typewritten table of contents for each volume, arranged in a systematic order.
  - 1. Contractor, name of responsible principal, address and telephone number.
  - 2. A list of each product required to be included, indexed to the content of the volume.
  - 3. List, with each product, the name, address and telephone number of:
    - a. Subcontractor or installer.
    - b. Maintenance contractor, as appropriate.
    - c. Identify the area of responsibility of each.
    - d. Local source of supply for parts and replacement.
  - 4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
- B. Product Data:
  - 1. Include only those sheets which are pertinent to the specific product.
  - 2. Annotate each sheet to:
    - a. Clearly identify the specific product or part installed.
    - b. Clearly identify the data applicable to the installation.
    - c. Delete references to inapplicable information.
- C. Drawings:
  - 1. Supplement product data with drawings as necessary to clearly illustrate relations of component parts of equipment and systems.
  - 2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
  - 3. Do not use Project Record Documents as maintenance drawings.
- D. Written text, as required to supplement product data for the particular installation:
  - 1. Organize in a consistent format under separate headings for different procedures.
  - 2. Provide a logical sequence of instructions for each procedure.
- E. Copy of each warranty issued.
  - 1. Provide information sheet for Owner's personnel, give:
    - a. Proper procedures in the event of failure.
    - b. Instances which might affect the validity of warranties.

### 1.4 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit six (6) complete copies of manual in final form and two compact discs (CD) in PDF format. CD shall include bookmarks and chapters to closely duplicate that of the paper copy.
- 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 all 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. Alignment, adjusting and checking.

3. Servicing and lubrication schedule:
  - a. List of lubricants required for each piece of equipment.
  - b. Schedule for manufacturer recommended maintenance.
4. Manufacturer's printed operating and maintenance instructions.
5. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
6. Other data as required under pertinent sections of specifications.

#### **1.5 SUBMITTAL SCHEDULE**

- A. Submit one copy of completed data in final form fifteen days prior to final inspection or acceptance. Electronic submittal for initial review is acceptable.
  1. Copy will be returned after final inspection or acceptance, with comments.
- B. Submit specified number of copies of approved data in final form 10 days after final inspection or acceptance.

#### **1.6 INSTRUCTION OF OWNER'S PERSONNEL**

- A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all 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 -**

**NO SPECIFICATIONS ON THIS PAGE FOR FORMATTING PURPOSES.**



**SECTION 13441**  
**INSTRUMENTATION COMPONENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK**

- A. This section provides information for instrumentation system components. The instrumentation components shall be furnished, installed, tested and calibrated complete, as described in this section, relevant other sections and as shown on the drawings. The Contractor shall calibrate all transmitters located at the SWWTF.

**1.2 RELATED SPECIFICATIONS**

- A. Section 16050 – Basic Materials and Methods
- B. Section 16480 – Motor Control Centers
- C. Section 16681 – Variable Frequency Drive
- D. Section 16690 – Electric Motors
- E. Section 16901 – I&C Systems
- F. Section 16913 – PLC and SCADA Programming

**1.3 QUALITY CONTROL**

- A. Instrumentation components shall conform to ISA standards.

**1.4 SUBMITTALS**

- A. Submittals shall conform to Section 01300.
- B. Provide component mounting and/or installation details as per manufacturers requirements.

**1.5 MANUFACTURER CONTINUITY**

- A. Wherever possible, all components shall be furnished from one manufacturer in order to facilitate installation, calibration, system function and Owner operation and maintenance.
- B. All components furnished herein shall be compatible with other portions of the control system specified elsewhere.

**PART 2 - PRODUCTS**

**2.1 FLOW DEVICES**

- A. Flow Switches
  - 1. The flow switches shall have a lower body which holds a flow vane and one magnet and shall actuate a separate magnet housed in an adjoining electrical housing above. The upper and lower housing shall be constructed of stainless steel with NPT threads. The electrical housing shall be removable for inspection or replacement without shutting down the pipeline, and be constructed of stainless steel.

2. The flow switch shall be a normally open contact and shall be actuated with a minimum flow of 2.0 gpm. The vane shall be stainless steel 11/16" wide by .020" thick. The switch shall be mountable in any position.
3. The electrical switches shall be an SPDT single snap action microswitch rated for 5 amp, 120/250 VAC, 60 Hz. Switches shall be W.E. Anderson, Model No. V4, or approved equal.
4. The flow switch shall be a normally open contact and shall be actuated with a minimum flow of 200 gpm. The vane shall be stainless steel 11/16" wide by .020" thick. The switch shall be mountable in the horizontal position in a 2½" PVC tapping saddle.
5. The electrical switches shall be an SPDT single snap action microswitch rated for 5 amp, 120/250 VAC, 60 Hz. Switches shall be W.E. Anderson, Model No. V4, or approved equal.

## 2.2 PRESSURE DEVICES

### A. Pressure Gauges

1. Pressure gauges shall be liquid-filled, bourdon tube gauges for line or panel mounting, as required. Gauges shall have bourdon tubes of 316 stainless steel, and 316SS connectors. Cases shall be stainless steel, with acrylic or shatter proof glass windows. Gauges shall be 4-1/2" diameter, with 1/2" MNPT bottom mount connections. Scales will be black on white background, 270 deg. span, appropriate to the application. Normal reading shall be at 1/2-2/3 of full scale. Gauge range shall be 0-160 psi, 0-300 psi, 0-30 psi, as required by the stream which it is monitoring.
2. Gauges requiring an isolation diaphragm as called for and as indicated on the drawings shall be supplied with an internal isolator, or external diaphragm seal. In either case, the bourdon tube shall be evacuated and filled with oil prior to assembly of the gauge with the isolator. Gauges and isolators shall be factory assembled and shipped as a unit.
3. All gauges shall be installed with snubbers, isolation tees for testing, isolation ball valves and be connected with 316 stainless steel tubing unless otherwise noted.
4. Pressure gauges shall be as manufactured by Ashcroft, or U.S. Gauge.

### B. Pressure Switches

1. Pressure switches shall be watertight die cast aluminum enclosures, NEMA 4, with Teflon/stainless steel actuator seals applicable to its exposed environment. Switching elements shall be narrow dead band type SPDT, 125 VAC, 15A. Switches shall be manufactured by United Electric.

## 2.3 TRANSMITTERS

### A. Pressure Transmitters

1. Transmitters used to measure reuse system pressure shall have all solid-state electronic circuitry and shall be of the 2-wire type, which requires no direct power connection to the transmitter. Transmitters shall be suitable for operation in ambient temperatures from -40° to 185° F, process temperature -40° to 250° F and relative humidity from 0 to 100%. All transmitters shall be constructed of corrosion-resistant Stainless Steel including isolating diaphragms, drain/vent valves, flanges and adapters. O-rings shall be Viton material. The transmitter shall be silicone oil filled and have an aluminum NEMA 4X housing. Transmitter shall have overrange protection up to 4500 psig on both ports. The transmitters shall be equipped with a 2" scale meter for local indication as indicated and required on the drawings. Local indication shall not be included unless specifically called for. Accuracy shall be .075% of

- calibrated range with repeatability of 0.1 percent. The transmitter output shall have 4 – 20 mA dc analog signal user selectable linear or square root, with a superimposed digital signal, using HART protocol. The analog output shall be adjustable remotely with a field communicator or control system. Zero and span adjustments shall also be available on the transmitter. Transmitter shall include stainless steel panel mounting brackets and 3-valve manifold. The transmitter shall have zero elevation and suppression regardless of output specified. The transmitters shall be factory calibrated from 0-100 psi. Transmitters shall be Model 3051CG as manufactured by Rosemount. Range shall be 0-300 psig for the RO trains.
2. Each transmitter shall be provided with a 316SS process shutoff valve, and ½" S.S. tubing and bracket for mounting as required. Transmitters shall be factory calibrated to the required range. Transmitters shall be Rosemount Model 3051CG.

## 2.4 WETWELL LEVEL DEVICES

- A. Level Transducer/Transmitter
  1. A continuous radar level transducer/transmitter with non-contacting sensor shall be provided for the wetwell as shown on the drawings. The sensor/transmitter shall be installed on the wetwell fitting.
  2. The sensor shall be manufactured of PVDF construction, have a 8° beam angle, and be mounted in the center of the wetwell. A pipe extension shall be provided should the sensor dead band require space between high liquid level and sensor face.
  3. The transducer/transmitter shall be mounted so that it will have a clear path perpendicular to the liquid surface. The path should not intersect the fill path, rough walls, seams rungs, etc.
  4. The transducer/transmitter shall have all solid-state circuitry and shall be of the two-wire type. The transmitter shall be suitable for operation in ambient temperatures from -40° to 140° F. The transmitter shall be NEMA 4X rated, have non-volatile EEPROM memory, have a liquid crystal display, have a 4-20 mA dc signal, one normally closed contact relay rated at 5A at 250 VAC non-inductive or 24 V dc, and shall have Hart protocol communication capability. Level transmitter shall be SITRANS LR110 Radar Level transmitter, or equal.

## 2.5 WEIGHTED FLOAT TYPE LEVEL SWITCHES

- A. Type:
  1. The switch assembly shall be weighted and suspended on its own cable.
- B. Functional/Performance:
  1. Temperature Rating - 0 to 50 degrees C
  2. Contact Rating - Up to 250V AC/DC, and 8 amps AC, 5 amps DC.
  3. Contact Arrangement - Form C contact which is field selectable normally open or closed.
- C. Physical:
  1. Contact - Sealed mercury switch housed in a chemical-resistant polypropylene casing.
  2. Flexible Support Cable - Synthetic three wire cable, minimum 19 AWG wire.
  3. Specific Gravity - Match to fluid being measured.
- D. Options/Accessories Required:
  1. Provide flexible support cable of sufficient length to ensure no splice or connection is required in the wetwell. Float cable length requirement varies per application.
  2. Provide junction box outside the wetwell for connection of cable.
  3. Provide stainless steel supports/mounting accessories as required.

- E. Manufacturers:
  - 1. FLYGT
  - 2. Anchor Scientific Rotofloat.
  - 3. Or Engineer and Owner approved equal.

### **PART 3 - EXECUTION**

#### **3.1 DRAWINGS AND DATA**

- A. Complete fabrication, assembly, and installation drawings; wiring and schematic diagrams; and details, specifications, and data covering the materials used parts, devices, and accessories forming a part of the equipment furnished shall be submitted in accordance with submittals section. Submittal data shall be grouped and submitted in three separate stages. Each stage submittal shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review. Instrument tag numbers indicated on the contract drawings shall be referenced where applicable.

#### **3.2 INSTALLATION**

- A. Installation shall be in complete accordance with manufacturer's instructions and recommendations.
- B. All electrical connections shall be made in conformance with the requirements of Division 16, Electrical.
- C. Once installation is complete, touch up damaged paint with manufacturer supplied paint.

#### **3.3 START-UP AND TEST**

- A. Contractor shall make adjustments required to place system in proper operating condition. Contractor shall field test and calibrate the equipment to assure that the system operates in accordance with these Specifications and to the satisfaction of the Engineer. The instruments shall be calibrated using standards whose accuracies are traceable to the National Institute of Standards Technology.
- B. Manufacturer's representative shall check and approve the installation before operation and assist Contractor in performing field tests and in calibration of the equipment.
- C. Contractor and system supplier shall provide the services of a factory-trained operating specialist for an eight-hour period for the instruction of the Owner's operating personnel.
- D. Unless otherwise noted, all instrumentation shall be coupled to the specific process with ½", 316 S.S. tubing.

#### **3.4 SPARE PARTS**

- A. Flow switch
- B. Level transmitter

**- END OF SECTION -**

## SECTION 16000

### ELECTRICAL GENERAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General Conditions, apply to all the Work specified in the Electrical 16000 Sections.

##### 1.02 LAWS, PERMITS, FEES AND NOTICES

- A. Secure and pay all permits, fees and licenses necessary for the proper execution of the Work. Submit all notices and comply with all laws, ordinances, rules and regulations of any public agency bearing on the Work. CONTRACTOR shall be licensed electrical CONTRACTOR in the county of construction.

##### 1.03 DEPARTURES

- A. If any departures from the Contract drawings or specifications are deemed necessary, details of such departures and the reasons therefore shall be submitted to the ENGINEER for advance written approval, prior to departure.

##### 1.04 GUARANTEES

- A. Furnish written guarantee covering all materials, workmanship, labor and equipment for a period of one (1) year from the date of acceptance as described in the Contract General Conditions.
- B. The OWNER reserves the right to operate and use all materials and equipment failing to meet the requirements of the Contract documents until such unacceptable materials and equipment are replaced or repaired to the satisfaction of the ENGINEER.

##### 1.05 AS-BUILT INFORMATION

- 1.06A set of "red-lined" electrical drawings shall be carefully maintained at the job site. Actual conditions are to be put on the drawings in red on a daily basis so the drawings will continuously show locations and routes of cable trays, conduits, pull-boxes, circuit numbers, and other information required by the ENGINEER.

#### JOB SITE VISIT

- A. Visit the project site before submitting a bid. Verify all dimensions shown and determine the characteristics of existing facilities which will affect performance of the Work, but which may not be shown on drawings or described within these specifications.

#### 1.07 CLEANUP

- A. Maintain a continuous cleanup during the progress of the Work and use appointed storage areas for supplies. The premises shall be kept free from accumulations of waste materials and rubbish.

#### 1.08 CUTTING AND PATCHING

- A. Cut and prepare all openings, chases and trenches required for the installation of equipment and materials. Repair, remodel and finish in strict conformance with the quality of workmanship and materials in the surroundings. Obtain written permission from the ENGINEER for any alterations to structural members before proceeding.

#### 1.09 MAINTENANCE

- A. Render all necessary measures to ensure complete protection and maintenance of all systems, materials and equipment prior to final acceptance. Any materials or equipment not properly maintained or protected to assure a factory new condition at the time of final acceptance shall be replaced immediately at no additional cost to the OWNER.

#### 1.10 WATERPROOFING

- A. Whenever any Work penetrates any waterproofing, seal and render the Work waterproof. All Work shall be accomplished so as not to void or diminish any waterproofing bond or guarantee.

#### 1.11 TESTS

- A. Conduct an operating test of equipment prior to the ENGINEER's approval. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications. The tests shall be performed in the presence of the ENGINEER or an authorized representative. The electrical CONTRACTOR shall furnish all instruments, electricity and personnel required for the tests.

## 1.12 SUMMARY OF ELECTRICAL WORK

- A. Provide all labor, materials, tools, supplies, equipment and temporary utilities to complete the Work shown on the drawings and specified herein. All systems are to be completely installed and fully operational. Specifically, the Work includes, but is not necessarily limited to:
1. Complete demolition of existing Reuse Control Panel and related wires – to be completed in phases so some of the pumps continue to operate.
  2. Replacement of existing motors with inverter rated motors.
  3. Provide modifications to existing MCC equipment; new breaker buckets and replace an existing 600A Reuse CP breaker for a new breaker to feed VFD per the drawings.
  4. Provide new exposed and UG raceways for power and control and instrumentation wires between VFD equipment, existing PLC control panel, and clearwell equipment.
  5. Provide new raceways and signal and control wires between PLC control panel and field instruments and equipment as required per plans.
  6. Provide modifications to existing PLC control panel, including programming of the existing PLC and HMI SCADA through the services of CSD Inc.
  6. Provide grounding system.
  7. Provide startup and testing of VFD equipment, motors, PLC controls, and field instruments.

## 1.13 CODES AND STANDARDS

- A. General Applicable provisions of the following codes and standards and other codes and standards required by the State of Florida and local jurisdictions are hereby imposed on a general basis for electrical Work (in addition to specific applications specified by individual Work sections of these specifications):

1. U.L.: Electrical materials shall be approved by Underwriters' Laboratories, Inc. This applies to materials which are covered by U.L. standards. Factory applied labels are required.
2. National Electrical Code.
3. OSHA: Standards of the Occupational Safety and Health Administration are to be complied with.
4. NEMA: National Electrical Manufacturers Association Standards are to be met wherever standards have been established by that agency and proof is specifically required with material submittals for switchboards, motor control centers, panelboards, cable trays, motors, switches, circuit breakers and fuses.
5. ANSI: America National Standards Institute
6. NESC: National Electrical Safety Code
7. Any and all local codes.

#### 1.14 ELECTRICAL TEMPORARY FACILITIES

- A. The electrical CONTRACTOR shall include in his bid the cost of furnishing, installing, maintaining and removing all materials and equipment required to provide temporary light and power to perform his Work during construction and until Work is completed.
- B. Safety
  1. All reasonable safety requirements shall be observed to protect workers and the public from shock and fire hazards. Ground fault interrupters shall be employed in accordance with codes.
  2. Ground wires are required in all circuits. Ground poles are required on all outlets. All metallic cases shall be grounded.
  3. Raintight cabinets shall be used for all equipment employed in wet areas.

#### 1.15 EXCAVATING FOR ELECTRICAL WORK

- A. General – Not needed



## 1.16 ELECTRICAL SUBMITTALS

### A. Submittals for Approval

1. Refer to Contract General Conditions for additional instructions on the General Conditions and this section, the more stringent requirements shall apply.
2. Shop Drawings and Manufacturer's data sheets are required for all electrical materials.
3. Submittals will not be accepted for partial systems. Submit all materials for each specification section at one time. Submittals must be arranged, correlated, indexed and bound in orderly sets for ease of review.
4. Samples are to be supplied for any substitute as requested by the ENGINEER.
5. The following numbers of copies are required:

Shop drawings	6 sets
Samples	1 each
Manufacturer's data	6 sets
Certifications	6 sets
Test reports	6 sets
Warranties/Guarantees	6 sets

6. Submit shop drawings, Manufacturer's data and certifications on all items of electrical Work prior to the time such equipment and materials are to be ordered. Order no equipment or materials without approval from the ENGINEER. Submittals will not be accepted for partial system submittals; submit all data at one time. Submittals will be promptly returned, approved, approved as noted, or not approved. Items "approved as noted" must be changed to comply with the ENGINEER's comments and need not be resubmitted for "approved" status. Items "not approved" are not suitable, requiring complete new submittals.
7. Time delays caused by rejection of submittals are not cause for extra charges to OWNER or time extensions. CONTRACTOR shall be responsible for investigating existing systems or shop drawings in order to fully integrate the new equipment into the system.

Adequate shop drawings may or may not exist for all existing systems.

**B. Operation and Maintenance Manuals**

1. Submit to the ENGINEER five (5) copies of all Manufacturer's service installation and operation manuals, instructions and bulletins. These manuals shall be subject to review of the ENGINEER. If acceptable they shall be forwarded to the OWNER. If not acceptable they shall be returned to the CONTRACTOR for revision and resubmittal. Manuals shall contain, but not be limited to, the following:
  - a. Brief description of system and basic features.
  - b. Manufacturer's name and model number for all components in the system.
  - c. List of local factory authorized service companies.
  - d. Operating instructions.
  - e. Maintenance instructions
  - f. Trouble shooting instructions
  - g. Manufacturer's literature describing each piece of equipment.
  - h. Power and control wiring diagrams
  - i. Parts lists

**1.17 ELECTRICAL PRODUCTS**

**A. Standards Products**

1. Unless otherwise indicated in writing by the ENGINEER, the products to be furnished under this specification shall be the Manufacturer's latest design. Units of equipment and components of the same purpose and rating shall be interchangeable throughout the project. All products shall be newly manufactured. Defective equipment or equipment damaged in the course of installation or test, shall be replaced or repaired in a manner meeting with the approval of the ENGINEER at no additional expense to the OWNER.

B. Delivery, Storage and Handling

1. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identification; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the Manufacturer specifically for exterior instructions for storage locations.

C. Substitutions

1. Comply with instructions in the Contract General Conditions and Special Conditions and obtain pre-approval of the ENGINEER regarding substitutions.

**1.18 SKILLED ELECTRICAL CRAFTSMEN**

- A. CONTRACTOR shall employ and staff the project with skilled Craftsmen experienced in the project requirements.
- B. As a minimum, a Licensed Journeyman Electrician shall be present on the project at all times.
- C. Other skilled persons shall be present as the project requirements dictate including Manufacturers representatives, start-up technicians, ENGINEERS, etc.

**1.19 DRAWINGS AND SPECIFICATIONS**

- A. Refer to the drawings for additional requirements. There are requirements indicated on the drawings which are not indicated in the specification.
- B. Bidders, suppliers, equipment vendors, General CONTRACTOR, Sub Contractors and other similar entities are required to read all the Contract documents including drawings and specifications.

**1.20 SCHEMATIC NATURE**

- A. Plan views are schematic in nature and meant to show the schematic arrangement of equipment and conduit.

- B. CONTRACTOR shall provide the OWNER/ENGINEER with an 11 x 17 (min) drawing (to scale) of the final layout of the equipment and conduit routing for approval. This drawing shall include measurements for all NEC required clearances and separations for equipment and conduit. Refer to other spec sections for conduit routing requirements.

#### 1.21 APPROVED SHOP DRAWINGS

- A. Use approved shop drawings for lay out of equipment. The Contract documents will vary from the shop drawings. Inform the ENGINEER immediately if there are lay out issues or inadequate space for equipment or clearances. Land conduits in openings of enclosures per the approved shop drawings, do not use the Contract drawings.
- B. Housekeeping pads, equipment racks and the like shall be based on the approved shop drawings.

#### 1.22 CLEARANCES

- A. It shall be the CONTRACTOR's responsibility to meet N.E.C. clearances about equipment.

#### 1.23 ROUTING

- A. Conduit routing is schematic in nature. Conduit routing is shown for clarity on the Contract drawings. See other spec sections for additional conduit routing requirements.

#### 1.24 FUTURE FACILITIES

- A. Where future facilities are indicated, conduit routing shall account for such facilities.

#### 1.25 DRAWINGS FURNISHED BY CONTRACTOR

- A. OWNER shall be provided all CONTRACTOR furnished drawings. Such drawings include, but are not limited to: Control panels, MCC.s, VFD.s, switch boards, instrumentation details, ATS, redline mark-up of the Contract drawing and the like.
- B. Drawings shall be furnished for review and approval. No materials shall be provided without the ENGINEER's approval.

- C. Final drawings shall be furnished or as field modified accounting for any changes made during start up.

1.26 HOMERUNS

- A. CONTRACTOR shall coordinate home runs between plan views. Where any conduit is shown in any plan view it shall be installed the entire length may be required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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## SECTION 16001

### ELECTRICAL DEMOLITION

#### PART 1 GENERAL

##### 1.01 GENERAL REQUIREMENTS

- A. Contractor shall take precautionary and safety measures to assure the safety of his personnel. All wires shall be identified and disconnected from power sources before removal.
- B. Contractor shall coordinate with the Owner, Engineer and Vendors.
- C. The general demolition scope shall also include the following minimum requirements whether indicated on drawings or not.
  - 1. Before demolition, Contractor shall verify that the equipment is no longer needed or that the demolition will not adversely effect plant operation.
  - 2. Removal of all exposed conduit. Removal of all wire within raceways, cabinets, outlet boxes, trenches and the like associated with equipment shown to be removed on plans.
  - 3. Removal of all hangers and support systems which are not needed as a result of the demolition.
  - 4. Contractor shall cover all openings as a result of demolition and removals including but not limited to the following:
    - a. Cabinets and enclosures
    - b. Wall and masonry openings.
    - c. Cut conduit, instrumentation line, etc. flush with slab, fill with concrete, patch and paint holes in walls.
- D. Operational Systems
  - 1. To the fullest extent possible, all required systems shall remain operational. Contractor shall replace and/or repair existing facilities which may be damaged due to equipment removals.

2. Where required wiring passes through or uses enclosures or raceways shown for demolition. Contractor shall provide raceways and wire as required to keep those systems operational.
  3. Contractor shall remove existing equipment in an orderly, planned and coordinated fashion. All replacement equipment shall be on site and ready to install immediately after the removal of existing equipment.
  4. Where indicated by drawings the Contractor may reuse portions of existing raceways as long as these are in good shape to be reused and provide same path to equipment.
  5. Where demolition interrupts the normal automatic control of the station, Contractor shall provide full time manual control until automatic control is restored unless otherwise directed by the Owner. Contractor shall obtain permission of the Owner before removing automatic control.
- E. Contractor shall be required to visit the site before bid to ascertain the magnitude of the Work. The drawings indicate the minimal effort. Any electrical raceway associated with any equipment shall be demolished. The drawings do not call out every item of work. All the building electrical equipment called out in the drawings to be installed or replaced shall be replaced with new, unless otherwise indicated by the drawings or noted elsewhere by the specifications.
- F. The Contractor shall provide to the Owner first choice of removed equipment in the event the Owner wants to salvage the equipment. In the event the Owner wants removed equipment, the Contractor shall provide this equipment to the Owner; all other equipment not wanted by the Owner shall become the responsibility of the Contractor to properly disposed of and pay all disposal costs and fees.
- G. Provide demolition in support of any civil or mechanical Work as may be required. See civil and mechanical documents.
- H. Demolish the magmeter and electronics.

#### 1.02 INCLUDED WORK

- A. Wellhead electrical and I&C equipment including pump control panel, RTU, former portions of conduit that may be demolished and the like.

#### 1.03 DISPOSITION OF EQUIPMENT

- A. Provide materials to the Owner as the Owner may require.
- B. Except as otherwise indicated, all removed or demolished electrical equipment shall become the property of the Contractor. All rubble shall be disposed of by the Contractor.



- C. Contractor shall load, transport, and dispose of all or demolished equipment including all enclosed gear, cabinets, raceways, wire and cable, supports, MCC sections, starters, circuit breakers, buckets, panel covers, light fixtures, rigid galvanized steel conduit and the like.

**PART 2** PRODUCTS (NOT USED)

**PART 3** EXECUTION (NOT USED)

END OF SECTION

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## SECTION 16050

### BASIC MATERIALS AND METHODS

#### PART 1 GENERAL

##### 1.01 SUBMITTALS

- A. Submit data sheets on all items per Section 16000.

##### 1.02 CODES AND STANDARDS

- A. General applicable provisions of the following codes and standards and other codes and standards required by the State of Florida and local jurisdictions are hereby imposed on a general basis for electrical Work (in addition to specific applications specified by individual Work sections of these specifications):
  1. U.L.: Electrical materials shall be approved by the Underwriters' Laboratories, Inc. This applies to materials which are covered by U.L. standards. Factory applied labels are required.
  2. NEC: National Electrical Code
  3. OSHA: Standard of the Occupational Safety and Health Administration are to be complied with.
  4. NEMA: National Electrical Manufacturers Association Standards are to be met wherever standards have been established by that agency, and proof is specifically required with material submittals for switchboards, motor control centers, panelboards, cable trays, motors, switches, circuit breakers, and fuses.
  5. ANSI: American National Standards Institute
  6. NESC: National Electrical Safety Code

#### PART 2 PRODUCTS

##### 1.03 GROUNDING MATERIALS

- A. All ground rods shall be 20-foot 5/8" copperclad, unless otherwise indicated.

- B. Around wires shall be soft drawn copper sized per National Electrical Code, unless otherwise indicated.

## 2.02 CONDUIT

- A. PVC Conduit
  - 1. PVC conduit shall be Schedule 80 or Schedule 40 unless otherwise noted and shall be U.L. approved. Comply with Federal Spec WC-1094 and NEMA TC-1.
- B. Flexible Conduit
  - 1. All flexible conduits shall be liquidtight, made of corrosion resistant plated steel with extruded polyvinyl covering and watertight connectors.
- C. Refer to schedule in drawing for location requirements.

## 2.03 CABLE, WIRE AND CONNECTORS

- A. 600 Volt Power Wiring
  - 1. Individual conductors shall be rated for 600 volts and shall meet the requirements below:
    - a. Conductors shall be stranded.
    - b. All wire shall be brought to the job in unbroken packages and shall bear the date of manufacturing; not older than 12 months.
    - c. Type of wire shall be THWN except where required otherwise by the Contract drawings.
    - d. No wire smaller than No. 12 gauge shall be used unless specifically indicated.
    - e. Conductor metal shall be copper.
    - f. All conductors shall be meggered after installation. Megger testing shall exceed 50 mega ohms.
  - 2. Multi-conductor cables shall be type TC UL 1277 THWN, PVC jacketed 600V with conductor and quantities as indicated.

- B. Instrumentation and Control Cable
  - 1. Process instrumentation wire shall be 16 gauge twisted pair, 600V., aluminum tape shielded, polyvinyl chloride jacketed, as manufactured by Houston Wire and Cable HW-106 or an approved equal.
- C. Control Cable
  - 1. Multi-conductor control cable shall be stranded 14 gauge, 600V. THWN insulated overall shielded with PVC jacket, as manufactured by Houston Wire and Cable HW-151 or an approved equal.

#### 2.04 TERMINATIONS AND SPLICES (600 VOLTS AND LESS)

- A. Terminations of power cable shall be by means of U.L. approved connectors. All connectors shall meet U.L. 486B and shall be compatible with the conductor material.
- B. Terminate all control and instrumentation cable with screw-clamp type terminal blocks.
- C. Splicing of power, control, or instrumentation wiring will not be allowed except by written approval of the ENGINEER. Where splicing is allowed, splices shall be made with approved compression connectors, and splices shall be made waterproof regardless of location.

#### 2.05 BOXES

- A. Boxes for wiring devices, switches and receptacles installed outdoors shall be weatherproof fiberglass with polycarbonate cover plates.

#### 2.06 PULL BOXES AND SPLICE BOXES

- A. Location
  - 1. Units used outdoor or in a damp or corrosive environment shall be 316 ss or fiberglass unless otherwise indicated on plans.
  - 2. Units used indoors in dry and clean A/C environments shall be NEMA 1.
- B. Size
  - 1. Units shall be sized per NEC as minimum.

C. Required Units

1. Plans depict minimum requirements. Additional units shall be provided as may be required to complete raceway systems.

2.07 MOUNTING AND SUPPORTING ELECTRICAL EQUIPMENT

- A. Furnish and install all supports, hangers, and inserts required to mount fixtures, conduits, cables, pull boxes, and other equipment.
- B. Support system used indoors in clean, dry and air-conditioned areas shall be galvanized steel. All other areas shall be 316 ss with ss fasteners.
- C. Perforated straps and wires are not permitted for supporting electrical devices. Anchors shall be of approved types.
- D. All supports, hangers, hardware, etc. used outdoors or in in non-air-conditioned indoor areas or in hazardous areas shall be non-ferrous, corrosion resistant or 316 stainless steel. Supports shall be selected to avoid galvanic reactions. Support devices shall be submitted for approval.
- E. Provide trapeze, bridge systems or wall bracketed cantilevered system to support the raceway system.
- F. Spacing of support systems shall be per NEC. Provide spacing of conduits according to the NEC and the materials used. For PVC conduit, refer to NEC table 347-8.
- G. Plans depict minimum requirements. Provide additional units as required to complete raceway system.

2.08 DUCT SEAL

- A. Provide Garvin Industries' duct seal or an approved equal
- B. Provide and install duct seal at all conduit ends for all new conduit installations.
- C. Duct seal shall be used to seal around junction boxes, control panels and the like. It shall be a permanently soft, non toxic compound. It shall also not affect other plastic materials or corrode metals.
- D. Duct seal shall be applied to the control panel conduit penetrations, VFD enclosure penetrations, analog and discrete terminal boxes conduit penetrations,

MCC conduit penetrations, and disconnects. Apply to each penetration but not more than 20-2" conduits per panel.

### PART 3 EXECUTION

#### 3.01 GROUNDING

- A. Provide ground system as indicated on the drawings and as required by the National Electrical Code.
- B. All raceways require grounding conductors. Metallic raceways are not adequate grounding paths. Bonding conductors through the raceway systems shall be continuous from main switch ground buses to panel ground bars of the panelboards, and from panel grounding bars of panelboards and motor control centers to branch circuit outlets, motors, lights, etc. THESE GROUND CONDUCTORS ARE REQUIRED THROUGHOUT THE PROJECT REGARDLESS OF WHETHER CONDUIT RUNS SHOW GROUND CONDUCTORS ON THE DRAWINGS.
- C. All connections made below grade shall be of the exothermic type.
- D. The grounding system test shall not exceed a 48 hour span dry resistance of 10 ohms. Additional grounding to meet this requirement shall be installed at no extra cost. Grounding and bonding connections shall not be painted.

#### 3.02 CONDUIT

- A. Locations:  
  
Conduits shall be used as follows:
  - 1. Refer to schedule on drawings.
- B. Installation
  - 1. Conduits subjected to rough handling or usage shall be removed from the premises.
  - 2. Conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Care shall be given that plugs or caps be installed before pouring of concrete.
  - 3. Where conduits pass through exterior concrete walls or fittings below grade, the entrances shall be made watertight.

4. Infurred ceilings, conduit runs shall be supported from structure, not furring.
5. Conduits entering panelboards, pull boxes, or outlet boxes shall be secured in place by galvanized locknuts and bushings, one (1) locknut outside and one (1) locknut inside of box with bushing on conduit end. The locknuts shall be tightened against the box without deforming the box. Bushings shall be of the insulating type.
6. Field conduit bends shall be made with standard tools and equipment manufactured especially for conduit bending.
7. Where embedded conduits cross expansion joints, furnish and install offset expansion joints or sliding expansion joints. Sliding expansion joints shall be made with straps and clamps.
8. Exposed runs of conduits shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of symmetrical bends. No attempts are made in plans to show required pull boxes, gutters, etc. necessary for the construction of the raceway system but the CONTRACTOR shall provide these raceways as may be required.
9. Conduits in structural slabs shall be placed between the upper and the lower layers of reinforcing steel, requiring careful bending of conduits. Conduits embedded in concrete slabs shall be spaced not less than eight (8) inches on centers or as widely spaced as possible where they converge at panels or junction boxes. Conduits running parallel to slab supports, such as beams, columns and structural walls shall be installed not less than 12 inches from such supporting elements. To prevent displacement during concrete pour, saddle supports for conduit, outlet boxes, junction boxes, inserts, etc., shall be secured.
10. Conduit runs shall always be concealed except where indicated on plans.
11. Pull lines shall be installed in all empty conduits. All pull wires shall be identified with conduit number at each end.
12. Where conduits are run individually, they shall be supported by approved pipe straps secured by means of toggle bolts or tapcons on hollow masonry; tapcons on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. The use of perforated straps or wires will not be permitted.



13. Wire shall not be installed until all Work of any nature that may cause damage is completed, including pouring of concrete. Mechanical means shall not be used in pulling in wires No. 8 or smaller.
14. Underground conduits not under concrete slabs are to be buried at least two (2) feet below finished grade for circuits rated 600 volts or less, except under traffic areas where motor vehicles may cross. Under traffic areas, conduits are to be buried at least three (3) feet below finished grade.
15. All conduits shall be cleaned by pulling a brush swab through before installing cables.
16. All conduits shall be sealed at each end with electrical putty. Special care shall be taken at all equipment where entrance of moisture could be detrimental to equipment. Approved backing gauze is required prior to the installation of conduit putty.
17. A maximum of two (2) feet of flexible conduit shall be used at connections of all motors, transformers, motor operated valve and gates, instruments and other items of equipment where vibration is present. It shall be supported where required with stainless steel bands.
20. PVC conduit shall be supported to walls and slabs using carlon snap strap conduit wall hangers. Two hole PVC conduit clamps shall not be permitted.

### 3.03 WIRES, CABLES AND CONNECTIONS

- A. Cables pulled into conduits shall be pulled using pulling eyes attached to conductors.
- B. Shields shall be grounded at only one termination point.

### 3.04 BOXES

- A. Installation of boxes shall be in accordance with the National Electrical Code requirements.
- B. Boxes shall be mounted plumb and level in accessible locations and mounting shall be secure, vibration resistant and galvanically compatible. Hardware shall be used that is specifically intended for the purpose. When mounted in corrosive, damp or wet locations, stainless steel hardware shall be utilized.

### 3.05 WIRING DEVICES

- A. Wiring devices shall be installed in device boxes approved for the application. All connections shall be made with screw terminals. Wiring devices shall be Leviton or approved equal.
- B. Wire devices on UPS systems shall be isolated ground, colored orange.
- C. Cover plates shall be provided as follows except as otherwise noted.
  - 1. Interior finished area – brushed aluminum
  - 2. Wet areas – gasketed plastic with flip cover.
- D. Receptacles installed outdoors, below grade, or in areas other than clean and dry environments shall be GFI and weatherproof. Receptacles shall be weatherproof with cords plugged in.
- E. All receptacles shall be GFI protected.

### 3.06 SUPPORTING DEVICES

- A. All items shall be supported from the structural portion of the building and studs, except standard ceiling mounted lighting fixtures and small devices may be supported from ceiling system where permitted by the ENGINEER. However, no sagging of the ceiling will be permitted. Supports and hangers shall be types approved by Underwriters' Laboratories.
- B. All floor-mounted devices (switchboards, motor control centers, transformers, etc.) shall be securely anchored to the floors. Where recommendations are made by Manufacturer, these recommendations shall be followed.

### 3.07 CLEANING

- A. All electrical equipment enclosures shall be thoroughly cleaned before acceptable by the OWNER. As a minimum, CONTRACTOR shall remove all debris including stripped wire insulation, dirt, and debris.

END OF SECTION

## SECTION 16480

### MOTOR CONTROL CENTERS

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. This section includes requirements for a motor control centers (MCC) and all required control devices as shown on the drawings and specified to be part of the MCC equipment.
- B. The MCC components shall be new MCC buckets for branch breakers at two existing MCC spaces and one existing branch breaker bucket to have its existing breaker changed out as indicated.

##### 1.2 SUBMITTALS

- A. Submit with the delivery of the MCC and Installation and Maintenance Manual and six (6) copies of the manufacturer's drawings per shipping block.
- B. Submit for approval fully engineered shop drawings including project specific schematics, elevations, dimensional data, etc. as a minimum six (6) sets shall be provided.
- C. Detailed fully engineered drawings shall be required. Standard schematics and product data will be rejected.

##### 1.3 REGULATORY REQUIREMENTS

- A. The MCC must conform to Underwriters Laboratory (UL) 845, current revision, the latest version of the National Electrical Code and NEMA ICS 2.

##### 1.4 PACKING/SHIPPING

- A. The MCC shall be separated into shipping blocks no more than three vertical sections each (when applicable). Shipping blocks shall be shipped on their sides to permit easier handling at the jobsite. Each shipping block shall include a removable "lifting angle" which will allow an easy means of attaching an overhead crane or other suitable lifting equipment.

##### 1.5 STORAGE

- A. If the motor control center cannot be placed into service reasonable soon after its receipt, it should be stored in a clean, dry and ventilated building free from

temperature extremes. Acceptable storage temperatures are from 0°C (32°F) to 40°(104°F).

## 1.6 WARRANTY

- A. The MCC shall be free from defects in materials and workmanship for a period of one (1) year from the date of acceptance by the Owner.

## PART 2 – PRODUCT

### 2.1 MANUFACTURERS

- A. Shall be Square D Company Class 8998 latest Model MCC, GE series 8000 and higher compatible with existing GE MCC, or approved equal.
- B. Where applicable, additions to existing MCC's shall be the same as the original manufacturer.

### 2.2 MATERIALS

- A. Steel material will comply with UL 845.
- B. Each motor control center shall consist of one or more vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly. A removable 7 gauge bottom structural steel lifting angle shall be mounted full width of the motor control center line-up at the top. Removable 7 gauge bottom channel sills shall be mounted front and back rear of the vertical sections extending the full width of the line up. Vertical sections shall have structural support members formed from a minimum of 12 gauge hot rolled steel. Internal reinforcement structural parts shall be of 11 gauge steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged to withstand all stresses included in transit and during installation.

### 2.3 MCC FINISH

- A. All steel parts shall be provided with UL listed acrylic baked enamel paint finish, except plated parts used for ground connections. All painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.
- B. Pre-treatment shall include:
  - 1. Hot alkaline cleaner to remove grease and oil.
  - 2. Iron phosphate treatment to improve adhesion and corrosion resistance.
  - 3. Non-chrome sealer to enhance corrosion resistance.

4. The paint shall be applied using an electro-deposition process to insure a uniform paint coat with high adhesion.
5. The standard paint finish shall be able to pass at least 300 hours of salt spray per ASTM B117 with less than 1/8" loss of paint from a scribed line.
6. Paint color shall be #49 medium light gray per ANSI standard Z55.1-1997.

#### 2.4 STRUCTURES (where applicable)

- A. Structures shall be totally enclosed, dead-front, free standing assemblies. Structures will be capable of being bolted together to form a single assembly.
- B. The overall height of the MCC shall not exceed 90" (not including base channel). Base channels of 1.5" in height shall be removable. The total width of one section will be 20" (widths of 25", 30" and 35" can be used for larger devices).
- C. Structures shall be NEMA 1A.
- D. Each 20 inch wide standard section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units.
- E. Each section shall include a top plate (single piece or two-piece) on NEMA 12 a bottom plate. Top and bottom plates shall be removable to ease the cutting of conduit entry openings.

#### 2.5 WIREWAYS

- A. Structures shall contain a minimum 12" high horizontal wireway at the top of each section and a minimum 6" high horizontal wireway at the bottom of each section. These wireways shall run the full length of motor control center to allow room for power and control cable to connect between units in different sections.
- B. A vertical wireway shall be provided in each motor control center section that accepts modular plug-in units. The vertical wireway shall connect with both the top and bottom horizontal wireway. The vertical wireway shall be 4" wide minimum with a separate hinged door. Access to the wireways shall not require opening control unit doors. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units must open directly into the motor control center horizontal wireways.

## 2.6 BARRIERS

- A. All power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a molded glass filled polyester support assembly that braces the bus against the forces generated during a short circuit. The horizontal wireway by a grounded a steel barrier. This barrier shall be removable to allow access to the bus and connections for maintenance.
- B. The vertical bus shall be housed in a modular glass-filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings every 3" for unit stab-on connections. Each opening shall have shutters that are attached to the structure so that when they are removed (to allow a stab connection) they are retained in the structure and are readily accessible for use should a plug-in unit be removed from the motor control center.

## 2.7 BUSSING

- A. All bussing and connectors shall be tin plated copper.
- B. The main horizontal bus shall be rated at continuous per the oneline diagram and shall extend the full length of the motor control center. Bus ratings shall be based on 65°C maximum temperature rise in a 40°C ambient. Provisions shall be provided for splicing additional sections onto either end of the motor control center.
- C. The horizontal bus splice bars shall be pre-assembled into a captive bus stack which can be easily installed into the end of the motor control center power bus to allow the installation of additional sections. The main bus splice (up to 600A) shall utilize bolts on each side of the bus split, for each phase. The splice bolts shall secure to self clenching nuts installed in the bus assembly. It shall be possible to maintain any bus connection with a single tool. "Nut and bolt" bus connections to the power bus shall not be permitted.
- D. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus and shall be rated at 600 amp continuous as a minimum. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. It shall be possible to maintain the vertical to horizontal bus connection with a single tool. "Nut and bolt" bus connections to the power bus shall not be permitted. When a back-to-back unit arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.

- E. A tin plated copper ground bus shall be provided that runs the entire length of the motor control center. The ground bus shall be 0.25" x 1.0" and be rated 300 amps. A compression lug shall be provided in the motor control center for a 4/0-250 MCM ground cable. The ground bus shall be provided with (6) 0.38" holes for each vertical section to accept ground lugs for all loads.
- F. Each vertical section shall have a vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.
- G. The power bus system shall be braced for a short circuit capacity of 42,000 RMS amperes minimum or as indicated on the drawings.

## 2.8 UNIT CONNECTIONS

- A. Units with circuit breaker disconnects through 250 amp frame and fusible switch disconnects through 200 amps shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with approximately sized cable or riser bus.
  - 1. Stabs on all plug-in units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted.
- B. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.
- C. All plug-on units shall utilize a two stage ADVANCE/RETRACT type operating mechanism which will allow the unit to disengage from the power bus without withdrawing the unit from the motor control center.
  - 1. In the ADVANCED position, the unit stabs shall engage the vertical phase bus. When the unit door is closed, the mechanism will allow complete "on"/"off" control of the unit disconnect with clear indication of the disconnect's status. All circuit breaker operators shall include a separate "tripped" position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door. A mechanical interlock shall prevent an operator from opening the unit door when the disconnect is in the "on" position. Another mechanical interlock shall prevent an operator from placing the disconnect in the "on" position while the unit door is open.

2. In the REACT position, the unit stabs shall be disengaged from the vertical phase bus. A non-defeatable mechanical interlock shall prevent the disconnect from being placed in the "on" position. A single standard padlock shall be able to lock the unit in the RETRACT position and simultaneously lock the disconnect in the "off" position. When in this RETRACT position, it shall be possible to close the unit door in order to maintain the enclosure's integrity.
  3. A non-defeatable mechanical interlock shall prevent installing or removing a plug-in unit from the structure unless the mechanism is first placed in the RETRACT position.
  4. The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.
- D. All non-plug-on units shall utilize a fixed position type operating mechanism which allows complete "on"/"off" control of the unit disconnect with the clear indication of the disconnect's status. All circuit breaker operators shall include a separate "tripped" position. A mechanical interlock shall prevent an operator from opening the unit door when the disconnect is in the "on" position. Another mechanical interlock shall prevent an operator from placing the disconnect in the "on" position while the unit door is open.
- E. Provisions shall be provided for locking all disconnects in the "off" position with up to three padlocks.

## 2.9 COMPONENTS

- A. Combination Starters (where applicable)
1. All combination starters shall utilize a unit disconnect as specified in the previous article. Square D Company Type S magnetic starters shall be furnished in all combination starter units, or an equal. All starters shall utilize NEMA rated contactors. Starters shall be provided with a three-pole, external manual reset, overload relay for thermal overload units.
  2. Control circuit transformers shall include two primary fuses and one secondary fuse (in the non-grounded secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads.
  3. When a unit control circuit transformer is not provided, the disconnect will include an electrical interlock for disconnection of externally powered control circuits.



4. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.
5. NEMA Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exist through the bottom of the starter cubical without entering the vertical wireway.

B. Terminal Blocks

1. Type B wiring is specified, all starter units shall be provided with unit control terminal blocks.
2. Terminal blocks shall be the pull-apart type rated at 20 amps. All current carrying parts shall be tin plated. Terminals shall be accessible from inside the unit when the unit door is opened. Terminal blocks shall be track mounted with the stationary portion of the block secured to the unit divider located below each unit. The stationary portion will be used for field connections and will remain attached to the cubical when the unit is removed. The terminals used for field connections shall be angled outward so that they can be wired without removing the unit or any of its components. The unit saddle or bucket shall be formed so that the unit can be removed without disturbing the stationary portion of the terminal blocks or any of the field control wiring. The removable portion of the terminal blocks shall be used for the unit wiring (factory connections).

C. Nameplates

1. Shall be engraved phenolic nameplates for each MCC and unit compartment. Shall be white background with black letters, measuring a minimum of 1.5" H x 6" W total outside dimensions.

2.10 QUALITY CONTROL

- A. The entire motor control center will go through a quality inspection before shipment. This inspection will include:
  1. Physical inspection of:
    - a. the structure and
    - b. the electrical conductors, including

- (i) bussing,
- (ii) general wiring, and
- (iii) units.

**B. Electrical Tests**

- 1. General Electrical Tests including:
  - a. power circuit phasing,
  - b. control circuit wiring,
  - c. meters and
  - d. device electrical operation.
- 2. AC Dielectric Tests of:
  - a. the power circuit and
  - b. control circuits.

**C. Markings/Labels, including:**

- 1. instructional type,
- 2. Underwriters Laboratory (U.L.), and
- 3. Inspector's stamps.

**D.** The manufacturer will use integral quality control checks throughout the manufacturing process to maintain the correctness of the MCC.

**2.11 Interrupting Ratings**

**A.** Main and branch device interrupting ratings shall be a minimum of 42,000 AIC and shall be increased as required to interrupt fault levels as indicated on drawings.

**2.12 Phase Monitors (where applicable)**

**A.** Provide Diversified phase monitor, with phase loss, undervoltage, phase sequence, auto reset, U.L. listed, provide auxiliary relays as may be required to lock out all motor loads.

2.13 CONTROL POWER TRANSFORMERS (where applicable)

- A. Provide CPT.s for motor units with 120 VAC secondaries. Provide primary and secondary fusing.

2.14 PILOT DEVICES (where applicable)

- A. Provide Square D, or equal pilot devices per plans, heavy duty 30mm, with engraved legend plates. All pilot lights shall not be transformer type units shall not be press to test.

2.15 SOFT START STARTERS (where applicable)

- A. Units shall be Alti-Start by Square D or an approved equal.
- B. Units shall be provided for pump control.
- C. Units shall be provided with separate accel and decel ramps.
- D. Upon fault units shall shunt trip the unit circuit breaker.
- E. Provide all logic for a complete and functional system, schematics indicate minimum pilot control.

PART 3 – EXECUTION

3.1 LOCATION

- A. Motor control centers are not to be placed in hazardous locations. The area chosen shall be well ventilated, free from excess humidity, dust and dirt. For indoor locations, protection must be provided to prevent moisture entering the enclosure.
- B. Motor control centers shall be located in an area which allow a minimum of 42 inches of free space in front of front-of-board construction. An additional 42 inches shall be provided in the rear of back-to-back construction. This free space will give adequate room to remove and install units. A minimum of ½” space should be provided between the back of front-of-board motor control centers and a wall (6” for damp locations).
- C. The motor control centers will be assembled in the factory on a smooth level surface so that all sections are properly aligned. A similar smooth and level surface will be provided for installation. An uneven foundation will cause misalignment of shipping blocks, units and doors. The surface under a motor

control center will be of a non-combustible material unless bottom plates are installed in each vertical section.

**END OF SECTION**

## SECTION 16681

### VARIABLE FREQUENCY DRIVE

#### PART 1 GENERAL

##### 1.01 WORK INCLUDED

- A. Provide a complete U.L. listed Variable Frequency Drive (VFD) systems as specified within and as indicated on the drawings. System shall be provided complete with all necessary accessories and appurtenances as required for a completely functional system ready for immediate use.
- B. Units shall be provided as specified below and with additional requirements as indicated on plans.
- C. Like items of equipment provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, operation and maintenance.
- D. See CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for this project.
- E. Drive shall have ampacity to serve the motor requirements. Coordinate with motor.
- F. Drives shall be provided by an approved Vendor that manufactures VFD equipment and it integrates it into a dedicated enclosure.
- G. Include motor vendor protective devices as indicated on drawings and motor vendor shop drawings.
- H. Drive system shall be sized for load, and include input line reactor and output filter to mitigate harmonics.

##### 1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of Section 01300 – Submittals.
- B. Fully Engineered shop drawings specific for this project shall be submitted to the Engineer for review and comment. Vendor shall clearly indicate his

conformance to the requirements of this specification. Along with standard literature, a detailed schematic and assembly drawings shall be provided. A recommended statement shall be provided. Vendor shall not release the unit for manufacture without approved shop drawings.

- C. Complete set of Operation and Maintenance Manuals shall be submitted.
- D. Warranty information shall be submitted.

### 1.03 QUALITY ASSURANCE

- A. All equipment furnished under this specification shall be new and unused, shall be the product of a manufacturer having a successful record of manufacturing and servicing the equipment specified herein for a minimum of five (5) years.

### 1.04 WARRANTIES

- A. Provide a full warranty covering labor, materials, the services of a factory authorized technician including all expenses for a period of one year, to begin after Owner's start-up and acceptance of the drive. During this period, manufacturer shall repair any failures associated with the drive.

### 1.05 NAMED MANUFACTURERS

- A. Square D
- B. Eaton
- C. Allen-Bradley
- D. No equal

## PART 2 PRODUCTS

### 2.01 VARIABLE FREQUENCY DRIVE (VFD)

- A. Provide a separate fully engineered Variable Frequency Drive (VFD) system for use with the pump/motor shown on plans. Power input shall be 480 volts, 3 phase; the drive shall include.
  - 1. Minimum drive inverter amps of output shall not be less than the amps as listed in Table 430-150 of the latest issue of the National Electrical Code.

2. Minimum drive overload capability shall not be less than 110% of the output rated amps for 60 seconds.
  3. Coordinate with pump vendor requirements to verify speed and torque requirements
  4. Coordinate with vendors and equipment suppliers regarding constant or variable torque applications and RPM of the driven loads. Provide units per applications.
  5. Include pump protective equipment as may be required.
  6. See the drawings for additional requirements.
- B. As a minimum, include the following features:
1. Exterior front cabinet door mounted equipment shall be as follows:
    - a. Hand-Off-Auto selector switch (may be part of Menu driven keypad).
    - b. Programmer/Monitor/Display Module and required appurtenances. Display shall indicate speed in percent.
    - c. Padlockable outside handle connected to disconnect the power supply to the unit before opening door. A defeater shall be provided.
    - d. Engraved legend plate shall be provided for all devices.
    - e. Run time meter hours, non-resettable, Electro-Mechanical Engler 200 Series or an approved equal.
  2. Main disconnect with current limiting fuses or circuit breaker connected to the padlockable door handle. Interrupting ratings shall match or exceed the values indicated in the main power service equipment. Min. value shall be 65,000 AIC or as otherwise indicated.
  3. Control power transformer with control circuitry and control logic as specified and as indicated on plans. Control power transformer shall be oversized for motor heat.
  4. Drive shall be provided with the capabilities to ride through brown outs and to restart on power loss and return after time delay.

5. Discrete output contacts shall be provided and wired to labeled terminal strip. Contacts shall be required as indicated per plans; one form "C" contact shall be provided. Additional slave relays shall be provided as required.
6. Provisions to receive hardwired 4-20 mADC signal for remote speed reference. Signal isolation shall be provided in the drive.
7. Joslyn lightning arrestors, Surgitron, 1454-01 or an approved equal wired to the line side of the disconnect.
8. 6-spare fuses of each size and type used shall be provided.
9. Provide drives with 18 pulse isolation transformers included inside VFD enclosure.
10. Provide output filters, Transcoil or an approved equal.
11. Units shall meet or exceed the requirements of IEEE 519. Provide additional labor and materials as may be required. Submit calculations for review and approval.
12. VFD controls shall include special equipment as may be required by pump and/or motor supplier including but not limited to sensor and additional pilot devices as required to fully implement, overtemp signals into the drive.

C. Operation

1. Hand-Off-Auto mode selector
  - a. Discrete control
    - (i) Hand: The drive ramps up to the speed reference per the local potentiometer or keypad setting.
    - (ii) Off: Drive ramps down and no power is applied to the motor. While in the off position, the drive is not permitted to run.
    - (iii) Auto: Drive start/stop control is from the PLC control panel. Upon receiving a start command, the drive ramps up to the remote speed reference. Upon



receiving the stop command, the drive shall ramp down to zero output.

b. Speed control

- (i) The speed reference shall be from the local potentiometer or keypad while the local H-O-A is in the hand mode and from command signal while in the automatic mode.
- (ii) Adjustable minimum and maximum speed settings shall be provided.
- (iii) Separate adjustable ramp slopes settings shall be provided for both acceleration and deceleration.

D. Enclosure

- 1. **Dimensions are critical.** Drawings indicate maximum space requirements. Unit shall fit in allowed enclosure. Inform Engineer if there are layout issues.

E. Technology

- 1. VFD units shall use 18 pulse with isolation transformers and Transcoil output filters or equal.

## 2.02 INTERFACING

- A. Units shall be connected with the PLC system via hard wire discrete and analog signals from the VFD equipment to the PLC I/O; See the drawings.
- B. Unit shall interface with existing plant SCADA via existing PLC controller. See the drawings.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Install equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance.

- B. Coordinate work with the Owner, the Contractor and work of other trades to avoid conflicts, errors, delays and unnecessary interference with operation of the existing plant during construction.
- C. Follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturers' instructions, and these Contract Documents, follow Engineer's decision, at no additional cost to the Owner. Keep a copy of manufacturers' instructions on the jobsite available for review at all times.

### 3.02 MANUFACTURER'S SERVICES

- A. Provide the services of a factory authorized service technician to start up, test and place in service the unit. This service shall be extended, as required, at the manufacturer's expense, if problems arise with the drive unit.
- B. Provide separate from the start up, one (8) hour on site training. This time shall be at the convenience of the Owner. Minimum training instructions shall include the following:
  - 1. Routine Maintenance
  - 2. Programming, including entering the programming mode, changing set points interpreting fault information.
  - 3. Trouble shooting
  - 4. Fault corrections and resetting actions.
- C. Programming
  - 1. Program VFD features per project requirements.
  - 2. Provide typewritten listing of final parameter setting with O&M manuals.

### 3.03 CLEAN-UP

- A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency and type of surface of the original finish.

END OF SECTION

## SECTION 16690

### ELECTRIC MOTORS

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. This section specifies the quality criteria, design standards, materials, and installation procedures not otherwise specified, required for electrical motors furnished under these Contract Documents.

##### 1.2 CONTRACTOR'S RESPONSIBILITY

- A. Furnish and submit shop drawings, operation and maintenance manuals, etc. as per the general conditions. In addition, the submission shall include the following technical information:
  - 1. Motor Efficiency
  - 2. Motor Torque Speed Curves from zero to full load speed.
  - 3. Nameplate data
  - 4. Special features like Inverter Duty rating
- B. The above information shall be supplied as part of the submittal on the equipment which the motor drives.

##### 1.3 STANDARDS

- A. Electric motors shall conform to the latest standards of IEEE, ANSI, and NEMA except as otherwise specified herein.

##### 1.4 CONDITIONS OF SERVICE

- A. Electric motors shall be designed and manufactured to operate under the following conditions except for specific variations stated in other sections of these specifications:
  - 1. Continuous Duty
  - 2. Altitude below 3300 feet.
  - 3. Ambient temperature 0 to 40° C maximum.

4. Voltage variation plus or minus 10 percent.
5. Unit shall be suitable for starting and running with power and control equipment provide for it.

## 1.5 TESTING

- A. Motors less than 50 hp: Each motor shall be subjected to a standard short commercial test including the following:
  1. Running light current
  2. Locked rotor current
  3. Secondary voltage at collector rings (wound rotor motors).
  4. High potential.
  5. Winding resistance
  6. Bearing inspection
- B. Motors 50 through 100 hp: Each motor shall be subjected to the above tests and shall be furnished with certified test results.
- C. Efficiency: Motors rated 25 through 100 hp shall be individually tested for efficiency.
- D. Motors larger than 100 hp: One motor from each identical order shall be furnished with certified test results. Each motor shall be subjected to a complete factory test consisting of full load heat run, percent slip, running light current, locked rotor current, breakdown torque (calculated), starting torque, winding resistance, high potential, efficiencies at 100, 75 and 50 percent of full load, and bearing inspection. The Engineer and Owner reserve the to witness these tests.
- E. Test Reports: Seven (7) copies of all test results shall be submitted to the Engineer for approval. Single copies of witnessed test raw data shall be submitted to the Engineer immediately upon completion of such tests.

## 1.6 TOOLS AND SUPPLIES

- A. Furnish all special tools necessary to disassemble, service and adjust the equipment.

## **PART 2 – PRODUCTS**

### ELECTRIC MOTORS

## 2.1 GENERAL

- A. The driven equipment manufacturer shall be responsible for supplying the motor and shall factory mount the motor to ensure proper coordination.
- B. Review plans and other specifications. Provide motor suitable for starting method.
- C. Where motors are used with variable frequency drive systems, they shall be provided as inverter duty, premium efficiency.

## 2.2 DESIGN OF MOTORS

- A. Horsepower: The driven equipment manufacturer shall be responsible for sizing the motors in coordination with the driven equipment so that the nameplate rated horse powers are not exceeded and motors are not required to operate within their service factor at any point within the driven equipment operating range. For variable speed application, the motor shall be designed for operation at the rated maximum speed and at reduced speeds down to 30% without overloading. The Engineer reserves the right to reject driven equipment which requires motors larger than the minimums specified in the other sections of these specifications or to require the Contractor to bear additional costs if larger electrical equipment is required.
- B. Temperature rise: Motors shall conform to standards of NEMA Class F Insulation System with a Class B rise unless otherwise listed in the other parts of these specifications.
- C. Voltage and Current: Fractional horsepower motors (less than ½ hp) shall be 115/208V or 115/230V, 60 Hz single phase. Motors ½ horsepower through 600 horsepower shall be 460 volts, 60hz, 3-phase.
- D. Service Factor: Unless otherwise specified, service factor shall be a minimum of 1.15.
- E. Speed: As specified with equipment.
- F. Torque: At least 20 percent greater than the maximum full load torque requirements of the driven equipment throughout the full operating range of the driven equipment from start to full load.
- G. Efficiency:
  - 1. Motors in the range of 1 hp to 200 hp, inclusive shall be designed specifically for energy efficiency and high power factor. In accordance

with NEMA Standard MG 1-12.53b, each motor shall meet the minimum guaranteed efficiency for the specified nameplate efficiency. All motor efficiency test shall be performed utilizing the NEMA preferred test method IEEE 112 method B, Dynamometer.

2. Motors larger than 200 hp shall have a minimum efficiency, at full load, of 95% and a minimum power factor of 85%.
3. Motors above 20 hp shall be “premium efficiency motors”: U.S. Electric Motors, General Electric or an approved equal.

H. Inverter Duty

1. Motor used on VFD systems shall be inverter duty rated.

## 2.3 MATERIALS AND CONSTRUCTION

A. Enclosure

1. The enclosure shall be the type as specified in respective parts of equipment specifications and shall be constructed of cast iron or fabricated steel components in proper position. Fans may form part of the rotor and shall be of non-sparking material on totally enclosed motors. Enclosures for motors not specified elsewhere, shall be TEFC, unless otherwise stated. Fractional horsepower motor enclosures shall be totally enclosed non-ventilated.

B. Insulation

1. Motors shall have inorganic, non-hygroscopic insulation unless otherwise noted in other parts of these specifications. Insulation shall be Class F rating.
2. Motors used on variable frequency drives shall have 1600V peak winding insulation systems.

C. Stator

1. The stator shall be assembled from high grade electrical sheet steel laminations adequately secured together.
2. The stator windings shall consist of materials such as polyester film, synthetic varnish or glass cloth. Windings shall be random or from wound, adequately insulated and securely braced to resist failure due to electrical stress and vibrations.

3. Any junction in motor insulation, such as coil connections or between slot and end winding sections, shall have protection equivalent to that of the slot sections of coils. The entire winding of all motors when finished, shall be epoxy encapsulated, after subjecting to a process which removes all moisture and insures freedom of air pockets.

D. Rotor

1. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses. The rotor shall be fabricated of high-grade electrical sheet steel laminations adequately fastened together and to the shaft. Squirrel cage windings may be cast aluminum or bar-type construction with brazed end rings.

E. Bearings shall be ball or roller.

1. Motors up to 1,000 horsepower shall have grease-lubricated, sealed bearings. Above 1,000 horsepower, lubrication shall be oil. Unless specified otherwise, the bearings shall have a B-10 life as follows:

<u>Motor hp</u>	<u>B-10 Life (hrs.)</u>
Less than 50	24,000
50 to 200	40,000
greater than 200	100,000

2. For vertical motors, thrust bearings shall be Kinsbury type, ball or roller bearings as required for the design thrust load. Guide bearings shall be radical type ball bearing.

F. Space Heaters (motor > 20 hp)

1. Unless otherwise indicated, 120-volt, single phase, space heaters shall be provided to maintain a motor temperature of approximately 10°C above a 40°C ambient. Maximum wattage shall be 200W.

G. Temperature switches (motor > 20 hp).

1. Provide motor winding thermostatic-controlled switch. The switch shall be normally closed and shall open upon high temperature condition.

H. Leads and Terminals

1. Leads shall be suitably marked and identified. Terminal housing locations, which are not shown on the Contract Drawings, shall be NEMA Assembly F-1.
- I. Motor Terminal Boxes
    1. Motor terminal boxes shall be provided separately for the power connections. **The thermal switch and heater connections shall be in a common box with conduit openings for this protective circuits and a separate conduit opening for power circuits. All terminal boxes shall be provided with threaded hubs.**
  - J. Grounding Means
    1. Each motor shall have adequate means for attaching #4/0 AWG copper grounding conductor to the motor frame near the base. It shall be a mechanical clamp terminal connector located on the same side as the stator lead junction box.
  - K. Direction of Rotation
    1. Motors shall be designed and manufactured for operation in a direction as required for driven equipment. The phase sequence, at the specification rotation, shall be marked permanently and plainly inside the stator lead junction box.
  - L. Noise
    1. All motors shall have an equivalent A-weighted sound level of 80 dp A as determined in accordance with IEEE Standard No. 85.
  - M. Nameplates
    1. Each motor shall have a stainless steel nameplate including the following minimum amount of information:
      - a. Manufacturer's type designation
      - b. Frame number
      - c. Output horsepower rating
      - d. Duty (time rating)
      - e. Rated load speed (rpm)



- f. Temperature rise in degrees centigrade at rated load, rotor and stator.
- g. Stator voltage rating
- h. Stator full load amperes
- i. Service factor (marked for operation at 40°C ambient)
- j. Frequency
- k. Number of Phases
- l. Inrush of locked rotor KVA
- m. Code letter designation
- n. Efficiency
- o. Bearing type, size, lubricant

### **PART 3 – EXECUTION**

#### **3.1 Installation**

- A. Motors shall be mounted in accordance with the motor manufacturer's drawings and instructions. Field installation of the unit shall include final alignment.
- B. Installation shall also include furnishing necessary oil and grease for initial operation and making final adjustments to place the equipment in operable condition.

#### **3.2 FIELD TESTS**

- A. A motors, their driven equipment and speed controllers (if applicable) shall be tested together after installation as described in the applicable sections of these specifications.

#### **3.3 PAINTING**

- A. Motors shall be assembled with pump at pump manufacturer's plant and shipped to the site with manufacturer's standard finishes. After installation and before being placed in final operation, the motors shall be painted in

accordance with the requirements of the specifications and consistent with the split case pump finish.

**END OF SECTION**

## SECTION 16901

### I&C SYSTEMS

#### PART 1 – GENERAL

##### 1.01 SCOPE OF WORK

- A. The Contractor shall furnish all instrumentation control equipment.
- B. Field instruments are specified elsewhere and/or indicated on drawings.
- C. Provide the modifications to the existing PLC control panel, including I/O cards to interface with the proposed VFD equipment and field instruments. Coordinate with Owner for I/O cards as Owner will provide some of the PLC I/O analog card.
- D. Interfacing status and alarms via hardwired controls with proposed VFD equipment. Refer to drawings.
- E. Provide the programming of the existing PLC 5 and the HMI SCADA interface via the use of Mark Biehl of CSD Inc (Control System Design Inc). CSD will work as a sub to the I&C Contractor.

##### 1.02 SINGLE INSTRUMENT SUPPLIER

- A. The Contractor shall assign to the Single Instrument and Control (I&C) supplier full responsibility for the functional operation of all new instrumentation systems. The Contractor shall have said supplier perform all engineering necessary to select, to furnish, to supervise installation, connection, to calibrate, to place into operation all sensors, instruments, alarm equipment, control panels, accessories and all other equipment as specified herein.
- B. The foregoing shall enable the Contractor and the Owner to be assured that the full responsibility for the requirements of this section will reside in an organization which is qualified and experienced in the water treatment field and its process technology on a functional system basis.
- C. Contractor shall review all specifications and plans. Contractor shall be sure all control panels equipment and the like are included in the bid. The following are suggested to be in the plant wide I&C Contractor's package. Major pieces of equipment include:
  - 1. VFD control via hard wire interface with PLC panel I/O
  - 2. PLC and SCADA programming of the equipment and

instrument status, alarms and readouts.

3. Field instruments and signal surge suppression for field Instruments.
4. Stanchion equipment and sunshields for field devices as required

### 1.03 NAMED MANUFACTURER

- A. CC Control
- B. Curry Controls
- C. Revere Controls
- D. No equal

### 1.04 INSTALLATION WORK

- A. Nothing in this part of the specifications shall be construed as requiring the Contractor to utilize personnel supplied by his assigned instrument manufacturer's organization or any division thereof, to accomplish the physical installation of any elements, instruments, accessories or assemblies specified herein. However, the Contractor shall employ installers who are skilled and experienced in the installation and connection of all elements, instruments, accessories and assemblies; portions of their work shall be supervised or checked as specified herein.

### 1.05 PREPARATION OF SUBMITTAL OF DRAWINGS AND DATA

- A. It is incumbent upon the Contractor to coordinate the work specified in these Sections so that a complete instrumentation and control will be provided and will be supported by accurate shop and record drawings. As part of the responsibility as assigned by the Contractor, the Single I&C supplier shall prepare and submit through the Contractor, complete and organized shop drawings, as specified herein. Interface between instruments, motor starters, flow meters, and existing instruments shall be included in his shop drawing submittal.
- B. In order to provide a fully coordinated system, shop drawings by other equipment vendors associated with the I&C control panel systems shall be reviewed and approved by the Contractor before submittal to the Engineer for approval.
- C. During the period of preparation of this submittal, the Contractor shall authorize direct informal liaison between his single I&C Supplier and the

Engineer for exchange of technical information. As a result of this liaison certain minor refinements and revisions in the systems as specified may be authorized informally by the Engineer, but these shall not alter the scope of the work or cause increase or decrease in the contract price. During this informal exchange no oral statement by the Engineer shall be construed to give formal approval of any component or method, nor shall any statement be construed to grant formal exception to, or variation from these specifications.

D. Operation and Maintenance Manual

1. Submit one preliminary O&M for review and comment by the Engineer. Provide five final O&M's, bound in a three ring binder. O&M shall include the requirements of I&C materials and minimally include the following: approved submittal data, start-up corrected as built shop drawings. O&M shall be neatly and logically arranged with a contents page followed by tabbed sections.

1.06 ADDITIONAL TECHNICAL SERVICES

A. At no additional cost to the Owner, the Contractor shall provide the services of qualified technical representatives of the Single I&C supplier:

1. To supervise installation and connection of all instruments, elements and components of every system, including connection of instrument signals to primary measurement elements and to final control elements such as pumps;
2. To make all necessary adjustments, calibrations and tests;
3. To program the HMI SCADA and PLC programming through the services of CSD, as a sub-contractor to the I&C supplier.
4. To instruct plant operating and maintenance personnel on instrumentation. This time shall be in addition to whatever time is required for other facets of work at the site and shall be during the Owner's normal working days and hours.

1.07 GUARANTEE

- A. The Contractor shall guarantee all equipment and installation, as specified herein, for a period of one (1) year following the date of completion of the work. To fulfill this obligation, the Contractor shall utilize technical service personnel designated by the Single I&C supplier to which the Contractor originally assigned project responsibility for instrumentation.

1.08 ADDITIONAL PROVISIONS

- A. The applicable provisions of the following sections under Electrical Work shall apply the work and equipment specified herein, the same as if stated in full herein:
1. Codes and Standards
  2. Equipment Materials and Workmanship
  3. Testing
  4. Grounding
  5. Equipment Anchoring
  6. Conductor and Equipment Identification
  7. Terminal Cabinets and Control Compartments
  8. Process Control Devices

#### 1.09 NEWEST MODEL COMPONENTS

- A. All meters, instruments and other components shall be the most recent field proven models marketed by their manufacturers at the time of the submittal of shop drawings unless otherwise specified to match existing equipment. All technical data publications included with the submittal shall be the most recent issue.

#### 1.10 COORDINATION

- A. I&C supplier shall coordinate with his supplier and other Contractors on the project. Where large subsystems are provided, the I&C supplier shall coordinate before the bid to be certain all equipment, engineering and labor are provided. Coordination item minimally includes: equipment dimensions, heat rejection, power requirements, control and signal requirements, and interconnection requirements.

#### 1.11 TEST PROCEDURE DEVELOPMENT AND DOCUMENTATION

- A. I&C subcontractor shall prepare and submit to the Engineer for review a detailed description of the test procedures that he proposed to perform to demonstrate conformance of the complete system of instrumentation and controls to this Specification.

- B. It is recommended that the I&C subcontractor develop the test procedures in two steps by first submitting general descriptions and outlines of the tests and then, upon receipt of approval, submit the required detailed procedures and forms.
  
- C. Operational Acceptance Tests
  - 1. The I&C subcontractor shall prepare check-off sheet(s) for each loop and an instrument calibration sheet for each active I&C element (except simple hand switches, lights, etc.). These check-off and data sheets shall form the basis for these operational tests and this documentation.
  
  - 2. Each loop check-off sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the completed loop by the I&C subcontractor.
    - a. Project name
  
    - b. Loop number
  
    - c. For each element: Tag number, description, manufacturer and model number, installation bulletin, and Specification sheet number.
  
    - d. Loop description
  
    - e. Installation check
  
    - f. Termination check
  
    - g. Calibration check
  
    - h. Adjustment check
  
    - i. Space for comments
  
    - j. Space for loop sign-off I&C subcontractor and date.
  
  - 3. Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit by Owner Representative and the I&C subcontractor.
    - a. Project name
  
    - b. Loop number

- c. Tag number
- d. Manufacturer
- e. Model number
- f. Serial number
- g. Calibration range
- h. Calibration data: Input, output and error at 0, 25, 50, 75, and 100% of span.
- i. Switch setting, contact action and dead band for discrete elements.
- j. Space for comments
- k. Space for sign-off by I&C subcontractor and date.

D. Functional Acceptance Tests

The I&C subcontractor shall prepare two types of test forms as follows:

1. For those functions that can be demonstrated on a loop-by-loop basis, the form shall include:
  - a. Project name
  - b. Loop number
  - c. Loop description
  - d. Test procedure description
  - e. For each component: Tag number, description, manufacturer and data sheet number.
  - f. Space for sign-off and date by both I&C subcontractor and Owner Representative.
2. For those functions that cannot be demonstrated on a loop-by-loop basis, the test form shall be a listing of the specific tests to be conducted. With each test description, the following information shall be included:



- a. Spec page and paragraph of function demonstrated
- b. Description of function
- c. Space for sign-off and date by both I&C subcontractor and Engineer.

## **PART 2 PRODUCTS**

### **2.01 TECHNICAL MANUALS**

- A. One preliminary O&M manual shall be submitted to the Engineer for review and comment. Assuming a favorable review the I&C supplier shall incorporate comments and forward the five final copies to the Engineer. If the preliminary O&M is not acceptable, the I&C supplier shall resubmit.
- B. Five (5) final sets of technical manuals shall be supplied for the Owner as a condition for final acceptance of the project. Each set shall consist of one (1) or more volumes, each of which shall be bound in a standard size, 3-ring, loose leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 3 inches.
- C. In addition to updated shop drawing information to reflect actual existing conditions, each set of technical manuals shall include installation, connection, operating, trouble-shooting, maintenance and overhaul instructions in complete detail. This shall provide the Owner with comprehensive information on all systems and components to enable operation, service, maintenance and repair. Exploded or other detailed views of all instruments, assemblies, and accessory components shall be included together with the complete parts lists and ordering instructions.
- D. Shop drawing files shall be provided in the latest version of Autocad with each O&M manual. Provide ACAD files on disk.

### **2.02 SPARE PARTS**

- A. The Contractor shall include, as part of the bid package, a list of recommended spare parts covering items required under these specifications.
- B. Minimum spare parts shall be provided boxed and identified including the following:
  1. 2-control relays of each type used.
  2. 2-timing relays of each type used.

3. 2-fuses of each size and type used.
4. 2-pilot lights of each size and type use.
5. 2-signal field surge arrester of each type used.
6. 2-signal panel surge arrester of each type used.
7. 2-incoming power lightning arrester of each type used.
8. 2-surge capacitor of each type used.

Also provide other spares as noted by the particular sections and paragraphs of other- specifications.

## 2.03 CONTROL PANELS

### A. General

1. I&C supplier shall construct the control panel to properly control internal and external equipment. No attempt is made to specify or indicate on plans, all required equipment but rather to set forth the minimum requirements.

### B. Engineering

1. I&C supplier shall provide system engineering and produce detailed fully engineered, coordinated and completed drawings.

### C. Construction

1. Control panel construction shall be per these specification and plans.

### D. Signal and Control Circuit Wiring

1. Wire Type and Sizes: Conductors shall be flexible stranded copper wire; these shall be UL listed TFFN, THWN, THHN and shall be rated 600v. Wire for control signal circuits shall be #16 AWG unless otherwise noted. All instrumentation cables shall be shielded #18 AWG with a copper drain wire unless otherwise noted. All special instrumentation cable such as between sensor and transmitter shall be supplied by the I&C supplier. Contractor shall increase wire size per load or impedance requirements.

### E. Wiring Instrumentation

1. All wires shall be run in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring run from components on a swing-out panel to components on a part of the fixed structure, (4) wiring run to panel mounted components on the door and the like. Wiring run on a swing out panel to other components on a fixed panel shall be made up in nylon wire ties bundles and secured so that bundles are not strained at the terminals.
2. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon ties and secured to the inside face of the panel using adhesive mounts and adhesive strips.
3. Wiring to rear terminals on panel mounted instruments shall be run in plastic wares secured to horizontal brackets run above or below the instruments in the same plane as the rear of the instruments.
4. Shields of instrument cable shall only be grounded on one side of each circuit. The side to be grounded shall be nearest the source of excitation.
5. Care shall be exercised to properly insulate the ungrounded side of the loop to prevent ground loops from occurring.
6. Conformance to the above wiring installation requirements shall be reflected by details shown on the shop drawings for the Engineer's review.

F. Wire Marking

1. Each signal, alarm, control, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors using white plastic heatshrink sleeves with typewritten characters. Instrument signal conductors shall be tagged with unique multiple digit numbers. Wires from the circuit breaker panelboard shall be tagged indicating the branch circuit breaker number.

G. Terminal Blocks

1. Compression type terminal blocks shall be molded plastic with barriers and box lug terminals, and shall be rated 15 amps at 600v and mounted securely to DIN rails. White marking strips fastened to the molded sections shall be provided and wire numbers and circuit identifications shall be marked thereon with machine printed marker on top. Terminal blocks shall be IEC style by Entelec M4/6 or an approved equal.

H. Wire Color

1. Wire color shall be, Line Power – Black; Neutral or common – White; AC Control – Red; DC Control – Blue; Equipment or Chassis Ground – Green; specified externally powered circuits – Orange.

I. Enclosures

1. Unless otherwise indicated, all enclosures shall be provided with the following.
  - a. Modified NEMA 3R, 316 stainless steel, gasketed, freestanding or wall mounted, bolted to concrete base.
  - b. Subplate for mounting equipment.
  - c. Padlockable, pocketed exterior doors.
  - d. Where required, provide stainless steel piano hinged dead fronts with quarter turn latches.

J. Identification

1. All components shall be identified using Lamicoid labels or an approved equal.

2.04 CONTROL PANEL EQUIPMENT

A. General Purpose Relays

1. General purpose relays in the control panel shall be the plug in type with contacts rated 10 amps at 120 vac as a minimum. The quantity and type of contacts shall be as required to accomplish the desired control task. Each relay shall be enclosed in a clear plastic heat and shock resistant dust cover. Relays shall be Potter and Brumfield or an approved equal. Differing mounting sockets shall be used to prohibit improper relay installations. Provide tube type base, 8 PIN or 11 PIN.

B. Time Delay Relays

1. Time delay relay shall be Diversified with digital settings or an approved equal. Timers shall be time delay on, interval on or time delay off relays, as required and shall be Diversified or an approved equal. Instantaneous contacts or auxiliary slave relays shall be provided as required. Provide tube type base, 8 PIN or 11 PIN.

C. Signal Isolators

1. Additional slave or interposing relays and signal isolators and signal converters shall be installed as required.

D. Circuit Breakers

1. Circuit breakers shall be single pole, 120vac, 15 amp rating or as required to protect wires and equipment; mounted on the inside of the enclosure or equipment remote from the enclosure.

E. Name Plates

1. Name plates shall be supplied for identification of control panels and all field mounted elements, including flowmeters and their transmitters. These name plates shall identify the instrument or meter, descriptively as to the function of the system. Nameplates shall be fabricated from black faced, white centered, laminated engraving plastic. A nameplate shall be provided for each signal transducer, signal converter, signal isolator, each electronic trip, and the like, mounted inside the control panels. These shall uniquely identify each control component. Adhesives shall be acceptable for attaching nameplates. Painted surfaces must be prepared to allow permanent bonding of adhesives. Nameplates shall be provided for instruments, function titles for each group of instruments and other components mounted on the front of the control panels as shown. Proposed colors, styles, height and text shall be submitted for approval.

F. Fluorescent Light (where required)

1. Provide fluorescent panel light mounted to subplate. Provide subplate mounted switch and outlet or handy box.

G. Vapor Guard (where required)

1. Moisture absorbing vapor guard shall be provided in each control panel.

H. Power Supplies (where required)

1. Power supplies shall be provided as required for loop power or other requirements for special equipment. Loop power supplies shall be Square D or an approved equal.

I. Circuit Breakers

1. Square D

2. Amperage ratings shall be indicated on drawings.

J. Fuses (where required)

1. Fuses and fuse holders 5 x 20mm, IEC style, with blown fuse indicating light.

K. Ground Fault Interrupting Receptacle (where required)

1. Leviton Duplex Receptacle or equal.

2. AC receptacle box shall be Steel City 58351-1/2 or equal.

3. Covers shall be Steel City 58-C-5, or equal.

L. Selector Switches and Push Buttons

1. Square D, Class 9001, Type K, or equal.

2. Operators shall be black knob type or key switch, 3-position or 2-position, push button or as noted.

3. Selector switches shall be spring return where noted.

4. Pushbuttons inserts

	<u>Label</u>	<u>Color</u>
a.	On	Green
b.	Off	White
c.	Start	Green
d.	Stop	White
e.	Reset	Black
f.	Acknowledge	Yellow

5. Selector Switch Operator

	<u>Label</u>	<u>Color</u>	<u>Text</u>
a.	All	Black	White

M. Indicator Lights

1. Square D, Class 9001, type K. Units shall be press to test, transformer type.

2. Lens color shall be as noted.

	<u>Label</u>	<u>Color</u>
a.	On	Green
b.	Off	White
c.	Open	Green
d.	Closed	White
e.	Hand	Yellow
f.	Auto	Green
g.	Local	White
h.	Remote	Green
i.	Alarm	Red
j.	Power available	White

N. Surge and Lightning Arrestors

1. All control panels shall be provided with surge and lightning arrestors as specified.
2. TVSS
  - a. Lightning surge suppressors shall be Innovative Technology PTX-160 Series, unless otherwise indicated.
3. Signal
  - a. Panel surge arrestors shall be Joslyn, 1800 Series.
  - b. Field surge arrestors shall be Joslyn, 1660-06.

2.05 FIELD INSTRUMENTS

A. General

1. The materials specified below shall establish the type and quality of materials used.
2. Refer to Civil, Mechanical, and Electrical drawings for additional requirements.

B. Floats

1. Provide non-mercury form "C" floats with cable lengths as required.
2. Anchor Scientific or equal.

3. Provide J-boxes for connection to conduit and wire systems.
- C. Level Indicating Transmitter
1. Provide a Vega radar type level sensor and transmitter for liquid level detection in reuse clear wells. Quantity per drawings.
  2. Provide unit made of materials compatible for waste water operation, along with diaphragm breather element as required for application.
- D. Flow switch
1. Provide a 1/2 " MPNT vane type flow switch with a non-metallic vane for wetted parts. Provide water proof Jbox, nonmetallic type. Dwyer industries or an approved equal.
- E. ELECTRONIC PRESSURE INDICATING/TRANSMITTER
1. gauge pressure and transmitting a linear 4 to 20mA dc output  
For use in a standard 24 vdc supply voltage system.
  2. The instrument range shall be fully adjustable throughout the  
Span limit. Accuracy shall be  $\pm 0.065\%$  of span. Long term  
stability of  $\pm .125\%$  of upper range limit for 5 years.
  3. All process-wetted parts of the instrument shall be Type 316  
stainless steel. The transmitter shall be protected by a gasketed,  
weatherproof NEMA 4X enclosure. The transmitter shall be approved  
for use in hazardous locations (non-incentive for Class I and Class II,  
Division 2 locations; intrinsically safe or explosion proof for Class I and  
Class II, Division 1 locations). Housing finish shall be epoxy.
  4. Transmitter shall include an integral special scaling analog meter and a  
stainless-steel bleed valve.
- F. Transmitter shall have a 1/2-inch NPT male thread process  
connection.
- G. Transmitter shall be provided with integral mounting bracket and hardware for  
installation location as shown on drawings.
- H. Transmitter shall be Model 3051S2C "Smart" as manufactured by Rosemount,  
Inc., no equal.
- I. Provide hand held programmer.



- J. Provide impulse tubing and isolation valves as may be required.
- K. Provide one spare transmitter for each type transmitter provided by the project.
- L. Provide Four Red Lion 1/8DIN size digital LCD display units with PID capabilities to display levels, pressures, and flow. Units shall Be capable of 4-20mA inputs and a repeating 4-20mA output . Provide option card for 4-20mA output. Units shall be mounted on existing PLC panel outer door and provide placards indicating their function (like REUSE CLEARWELL LEVEL, or REUSE FLOW and the like )

## 2.06 NAMEPLATES, NAME TAGS AND SERVICE LEGENDS

- A. All components provided under this section, both field and panel mounted, shall be provided with permanently mounted name tags bearing the entire IA tag number of the components. Panel mounted tags shall be plastic; field mounted tags shall be stamped stainless steel.
- B. The panel drawings refer to nameplates and service legends: nameplates are defined as inscribed laminated plastic plates mounted under or near a panel face mounted instrument. Service legends are defined as inscribed laminated plastic integrally mounted on a panel face mounted instrument.
- C. Service legends and nameplates shall be engraved, rigid, laminated plastic. Service legends and nameplates shall be fastened to the panel by screws or with a specially applied adhesive. Fastening shall not depend only on the adhesive.

## PART 3 EXECUTION

### 3.01 INSTALLATION, CALIBRATION, TESTING, START UP AND INSTRUCTION

- A. General
  - 1. Under the supervision of a Single I&C supplier, all systems specified in this section shall be installed, connected, calibrated and tested and in coordination with the Owner and Engineer shall be started to place the process in operation. This shall include final calibration in concert with equipment specified elsewhere in these specifications as well as equipment provided by the Owner.
- B. Installation and Connection
  - 1. The Contractor shall install and connect all field mounted components and assemblies under the criteria imposed in 1.3, herein. The

installation personnel shall be provided with a final reviewed copy of the shop drawings and data.

2. The instrument process lines, impulse piping lines and air signal tubing shall, in general, be installed in a similar manner to the installation of conduit specified under Section 16000.
3. Bends shall be formed with the proper tools and to uniform radii and shall be made without deforming or thinning the walls of the tubing.
  - a. Unless otherwise indicated, all fittings, adapters, impulse piping, valves, etc. shall be 316 stainless. Valves shall be Whitey Series 40 or an approved equal.
4. The Contractor shall have a technical field representative of the I&C supplier to instruct these installation personnel on any and all installation requirements; thereafter the technical field representatives shall be readily available by telephone to answer questions and to provide clarification when needed by installation personnel.
  - a. Where primary elements (supplied by the I&C supplier) will be part of a mechanical system, the I&C supplier shall coordinate the installation of the primary elements with the mechanical system manufacturer.
5. After all installation and connection work has been completed, the technical field representatives shall check all for correctness, verifying polarity of electric power and signal connections making sure all process connections are free of leaks and all such similar details. The technical field representative shall certify in writing to the Contractor that for each loop or system he has completed such check out and that any discrepancies have been corrected by the installation personnel.
6. The field representative of the I&C supplier shall coordinate all work required to interface the new equipment, including all required modifications to the existing equipment and related devices.

C. Calibration

1. All new instruments shall be calibrated.
  - a. All instruments and systems shall be calibrated after installation, in accordance with the component manufacturer's written instructions. This shall provide that those components having adjustable features are set carefully for the specific conditions and applications of this installation and that the

components and/or systems are within the specified limits of accuracy. Defective elements which cannot achieve proper calibration or accuracy, either individually or within the system shall be replaced. This calibration work shall be accomplished by the I&C Supplier.

- b. Proof of Conformance – The burden of proof of conformance to the specified accuracy and performance is on the Contractor using his designated I&C supplier. The Contractor shall supply necessary test equipment and technical personnel if called upon to prove accuracy and performance at no additional cost to the Owner, wherever reasonable doubt or evidence of malfunction or poor performance may appear within the guarantee period.

D. Testing

1. All systems shall be exercised through operational tests in the presence of the Engineer in order to demonstrate achievement of the specified performance. Operational tests depend upon completion of work specified elsewhere in these specifications. The scheduling of the test shall be coordinated by the Contractor among all parties involved so that the tests may proceed without delays or disruption by incomplete work.
2. All functional/loop tests shall be witnessed and signed off by the Owner's representative and the I&C subcontractor.
3. Contractor shall provide testing service in conjunction with the PLC/SCADA program developer. Contractor shall include a maximum of 20 man hours for this service. If problems are found as a result of I&C equipment additional time shall be provided as may be required. .

E. Training

1. Plant operating personnel shall be provided with training prior to start-up.
2. Two 4 hour training sessions shall be provided. Training shall be at a time convenient to the Owner.
3. Operating and maintenance personnel shall be instructed in the functions and operation of each system and shall be shown the various adjustable and set point features which may require readjustment, resetting or checking, recalibration or maintenance by them from time to time. This instruction shall be scheduled at a time arranged with the

Owner at least two (2) weeks in advance. Instruction shall be given by qualified persons employed by the I&C supplier.

F. Start Up

1. When all systems are assessed by the Contractor to have been successfully carried through complete operational tests with a minimum of simulation, and the Engineer concurs in his assessment, start up by the plant operating personnel can follow.

END OF SECTION

## SECTION 16913

### PLC AND SCADA PROGRAMMING

#### PART 1 GENERAL

##### 1.01 GENERAL REQUIREMENTS

###### A. Contractor Responsibilities

1. Install and configure all hardware.
2. Test and demonstrate all hardware.
3. Provide assistance during testing and demonstration of hardware, as may be required.
4. Provide PLC and SCADA programming by using the services of Mr. Mark Biehl of CSD Inc (Computer Systems Design Inc)

###### B. Owner's Responsibilities

1. Provide As built info and PLC I/O cards for existing PLC 5.
2. Unless otherwise noted or indicated, all PLC and SCADA programming shall be provided by Control Systems Design.

#### PART 2 PRODUCTS (not used)

#### PART 3 EXECUTION (not used)

END OF SECTION

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## APPENDIX A: REUSE CONTROL LOGIC



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## Control Logic

To: **Indian River County Utilities**

From: Kimley-Horn and Associates, Inc.

Date: November 23<sup>rd</sup>, 2020

RE: **South County Regional Wastewater Treatment Facility  
Reuse Control Panel Replacement  
Kimley-Horn Project No: 044572065**

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## BACKGROUND

Indian River County Utilities' reuse system is served through the on-site pump station, which consists of three (3) 100-hp vertical turbine pumps and a subgrade wet well. The station operates similar to a conventional lift station, where pumps are called to run/stop via mercury switch floats. The control panel for the lift station is located outside on a separate pad, directly adjacent to the wet well. The starters for the 100-hp pumps are across the line (ATL) motor starters and are located in the existing "Reuse Control Panel" on the north side of the pump station wetwell structure. Power and signal wiring from the reuse station are provided through an existing electrical building located near the pump station.

IRCU desires to upgrade the following components of the reuse pump station:

- Demolish ATL starters and replace with Variable Frequency Drives (VFDs) to reduce energy consumption and mitigate water hammer issues
- Locate the VFDs within the existing electrical building
- Demolish the existing control panel and provide local motor disconnect switches by each pump
- Provide continuous analog measurement of wet well level and discharge pressure

The intent of the control logic description is to provide the integrator with the information necessary to program operation of the station. The description presents the proposed operation logic for the reuse pump station under AUTO and MANUAL modes.

The existing Programmable Logic Controller (PLC) Panel 1 ("PLC Panel 1") accepts signals through input/output (I/O) cards and relays them to the existing WWTF SCADA system. This control panel is located inside the electrical building will be re-used to accept hard wired signals from the VFDs. The existing control panel that is located adjacent to the pump station wet well will be demolished. Refer to PID drawing I-2 for reference to existing/proposed instruments and equipment.

## WETWELL AND PUMP OPERATION – LEVEL CONTROL

There are three (3) existing 1,800 gpm vertical turbine pumps with 100-hp constant speed motors, one of which provides the majority of pumping capacity with the second needed only during peak flows. All three pumps are equally sized and will be driven by variable frequency drives (VFDs).

The reuse pump station will operate based on level within the wetwell. The proposed normal operation is to maintain level in the wetwell using VFD's to drive the pumps, such that as flow increases to the wetwell, the pump VFD's ramp up to maintain a constant level. If flows diminish to a rate that is less than the slowest





speed of one pump, the water surface level will drop to a point where the pump in operation is turned off (OFF All Pumps level) and the wetwell level cycles (rises) like a typical lift station.

As water level rises, the 1<sup>st</sup> pump in the run sequence should start at a liquid level, "1<sup>st</sup> PUMP START," below the "MAINTAIN LEVEL," in order to allow for ramp up time and reaction to surges in the wetwell. Ramp up can be gradual and the PID loop control can be enabled as the difference between the two settings narrow. When the 1<sup>st</sup> pump capacity is greater than the flow entering the wetwell at its minimum speed (60% ~ adjustable), the level will continue to drop to the "STOP ALL" setting and the 1<sup>st</sup> pump will stop.

When the water level rises in the wetwell, the speed of the pumps increase accordingly (directly proportional loop) in order to maintain a constant liquid level in the wetwell. When the level continues to rise and the pump's speed is 100% for a predetermined time, or the next "2<sup>nd</sup> PUMP START" start trigger level is achieved, the 2<sup>nd</sup> VFD/pump is called to run and both operate at a common speed, controlled by the PLC PID loop. Vice versa, as the level drops, the VFD ramps down to maintain a constant level. If the 2<sup>nd</sup> VFD speed reaches a minimum speed (60%), they shut off in sequence and the remaining pump that is operating will continue to lower the liquid level until it reaches "STOP ALL" Level. The pump minimum speed setpoint can be adjusted through operator input on the HMI for values < 60%. The station should be programmed to not accept command speed values less than 60%. This action is necessary to avoid situations where the pump is in operation but not pumping fluid, which can result in deterioration of pump components. This minimum speed value will be confirmed during startup of the station.

The reuse pump station will progress through the three (3) pumps based on a pump run sequence. The pump run sequence is proposed to be automatically alternated every 24 hours but is adjustable via the WWTF's Human Machine Interface (HMI). At the end of 24-hour runtime, the PLC will call for the "NEXT PUMP TO START" in the sequence and stop the "NEXT PUMP TO STOP" in the sequence. With this setup, the pump operation sequence remains unchanged, unless it is manually changed by the operator via HMI. When the liquid level rises to the "1<sup>st</sup> PUMP START" level, the 1<sup>st</sup> pump in the sequence will start and operate to maintain liquid level. Alternation of pump/VFD sequence occurs automatically in order to provide consistent run times for pump motors and transition should provide seamless transfer of flows to the reuse water main.

Each of the VFD's should be in AUTO if considered to be included in the level control matrix. If a VFD is in MANUAL, OUT OF SERVICE, in ALARM condition, or FAILs to run, that pump will be bypassed in the pump call sequence since the permissive statuses are not achieved. The 3<sup>rd</sup> pump will always be included in the pump run sequence but will only be called to run in case of high-water level in the wetwell, which is expected to be infrequent.

Flow switches are proposed to be installed on the discharge of each reuse pump, upstream of the gate valve. Limit switches on the swing check valve, or flow switches installed on the discharge piping between the swing check valve and the isolation valve, are proposed. These switches will be hard wired to each respective pump VFD to stop pump operation when no flow is detected.

## LEVEL CONTROL

Electrical and instrumentation improvements are proposed to modernize operation of this station, but operation of the reuse pump station will continue to be based on water level in the wetwell. Two (2) radar level transmitters are proposed to be installed in the wet well ("LIT A" and "LIT B") to initiate pump operation. The LITs will be hardwired to the PLC Panel 1 at different analog input cards to provide redundancy. Selection of the primary wetwell level transmitter will be via HMI (A or B). The HMI will also contain an A-



B differential level setpoint via operator input, should there be a considerable difference in level measured by the transmitters, an alarm status will occur. In automatic mode, the transmitter selected through the HMI will be used to operate the station. The HIGH LEVEL state will trigger an alarm status in the PLC and will also call for the Reuse Station Bypass valve to OPEN, resulting in flows being directed to the RIBs. The following level settings are proposed and adjustable\*:

ALARM/STATE	WATER LEVEL (ft)	DISTANCE TO WATER SURFACE (ft)
LOW LEVEL Alarm	4.5	11.75
STOP ALL Pumps	6.0	10.25
1 <sup>st</sup> PUMP START	8.0	8.25
MAINTAIN LEVEL	9.0	7.25
2 <sup>nd</sup> PUMP START	10.0	6.25
HIGH LEVEL Alarm	11.5	4.75
3 <sup>rd</sup> PUMP START	12.25	4

\*Elevations to match existing float elevations, to be confirmed.

### BACKUP FLOAT SYSTEM

In general, the back-up float system is strictly a backup to the automatic level control operation, PLC and level transmitter system for the station. The backup system involves two mercury switch floats, one for low level and one for high level, should failure of the VFDs and/or PLC (station) occur. The High Float Level Alarm float will call for the Reuse Station Bypass valve to OPEN, resulting in flows being directed to the RIBs. The low float level alarm will remain as an alarm status through the HMI. The following float settings are proposed:

ALARM/STATE	WATER LEVEL (ft)	DISTANCE TO WATER SURFACE
*Low Float Level Alarm	4.0	12.25
*High Float Level Alarm	12.0	4.25

\*Elevations outside of LIT

### HISTORICAL TRENDING ARCHIVES

Provide historical data storage and trending capability of all analog signals, including, but not limited to:

- Reuse water distribution pressure
- Pump station wet well level (A & B)
- Pump station outlet/distribution flow
- Totalized Today/Yesterday Pump Start Counts
- Totalized Today/Yesterday Pump Runtime Data
- Total Pump Runtime data