

**ADDENDUM #8  
BID NO. 2009-T**

**Issue Date: August 26, 2009**

**Project: South Columbia County Regional Wastewater Treatment Plant**

Notice to all bidders is hereby given that the following modification is made to the Request for Bids referenced above:

**Lift Stations and Controls**

The lift stations shown on Sheet Alt-5 are amended to include the following:

**South Side Lift Station Pump Requirements:**

300 gpm @ 57 ft TDH  
Max Hp = 7.5 Hp  
Electrical = 230 V – 3 Ph  
Discharge = 4"

**North Side Lift Station Requirements:**

No pumps or electrical appurtenances installed.

Construction includes:

- Wet Well
- Rails
- Discharge Elbow
- Valve vault and piping – 4"
- Fencing

**Controls**

Controls for the South Side Lift Station shall be in accordance with the attached Specification, Section 16600.

**Each bid submitted in response to this Request for Bids shall include an acknowledgement of this addendum.**

## SECTION 16600

### PUMP STATION ELECTRICAL AND CONTROLS

#### 1.01 ELECTRICAL WORK – GENERAL

##### A. RELATED DOCUMENTS

1. The general provisions of the contract, including General Conditions and General Requirements, apply to the work specified in this section.

##### B. DESCRIPTION OF WORK

1. Furnish all labor and materials required to complete the electrical work indicated on the Drawings or herein specified.
2. Arrange with COLUMBIA COUNTY for providing such electrical services as indicated on Drawings or herein specified.
3. Furnish and install complete electrical lighting and power systems.
4. Connect all meters, disconnect switches, motor starters, panelboards, circuit breakers, controls, convenience outlets, switches, and/or other equipment forming all parts of the systems. Provide/install proper electrical service to all equipment installed on this project.
5. Procure and pay for permits and certificates as required by local and state ordinances and Fire Underwriters certificate of inspection.
6. Visit the sites and determine conditions which affect this contract. Failure to do so will in no way relieve Contractor of his responsibility under this contract.
7. Submit to Engineer a certificate of final inspection from local and/or state inspection authorities.

##### C. DRAWINGS

1. Drawings indicate diagrammatically the extent, general character, and the approximate location of the work to be performed. Where work is indicated but with minor details omitted, furnish and install the work complete so as to perform its intended functions. Review all engineering drawings and specifications as part of this bid package for details, and fit electrical work thereto.
2. Take finish dimensions at job in preference to using scale dimensions.
3. Except as noted above, make no changes in or deviations from the work

as shown or specified except on written order of the Engineer.

#### D. MANUFACTURER'S DRAWINGS AND DATA

1. Within thirty (30) days after award of contract, submit six (6) copies of manufacturer's drawings to the Engineer for review of the following items:
  - 1) Motor Starters.
  - 2) Disconnect Switches.
  - 3) Lighting Fixtures.
  - 4) Multi-trode.
  - 5) Electrical Panel.
  - 6) Packaged Air Conditioning Units.
  - 7) Identification Nameplates for all equipment. Submit type, style, and sizes with exact wording.
  - 8) Control Systems and Associated Hardware and Equipment.
  - A) Component manufacturing data sheets showing operating data, dimensions, mounting details, and connection details.
  - B) Detailed loop diagrams showing piping and wiring requirements for all controls.
2. Submit proposed system for identification of conductors.
3. Partial submittals will not be acceptable. All shop drawings shall be in one submittal. Drawings of power equipment shall contain exact details of device placement, phasing, and numbering in elevation form.

#### E. PROGRESS OF WORK

1. Schedule work as necessary to cooperate with other trades. Do not delay other trades. Maintain necessary competent electricians and supervision to provide an orderly progression of the work.
2. This Contractor shall review all plans and become informed as to equipment furnished by other trades. The Owner shall not be liable for added cost incurred by equipment substitutions made by others which require excess electrical wiring or equipment above that indicated on drawings or specified.

#### F. WORKMANSHIP

1. All work shall be executed in a workmanlike manner and shall present a neat appearance upon completion.

## G. QUALITY ASSURANCE

1. The total electrical and control systems are made up of a number of integrated sub-systems; and, as such, shall be furnished by the Contractor, who shall provide all of the equipment and appurtenances regardless of manufacturer and be responsible to the Engineer for satisfactory operation of the entire system. Substitution on functions specified will not be acceptable.
2. It is intended that the Motor Starters, Controls, and Submersible Pumps be furnished as one package by the same manufacturer and/or supplier to assure that each is compatible with the other.

## H. INSURANCE

1. This Contractor shall carry Worker's Compensation Insurance and Public Liability Insurance, and shall hold Owner free from damage from claims or suits arising out of the performance of this contract.

## I. PROTECTION OF PERSONS AND PROPERTY DURING CONSTRUCTION

1. Take all precautions necessary to provide safety and protection to persons and protection of materials and property, including protection from injury from rotating or moving equipment, tools, hot surfaces, holes, shafts, falling objects, electrical energy, and all other potential hazards. Erect signs, barricades, warning lights, etc., as required to provide such protection. Instruct workers and all others who may be subject to construction hazards.
2. Protect items of equipment from stains, corrosion, scratches, and any other damage or dirt, whether in storage, at job site, or installed. No damaged or dirty equipment, lenses, or reflectors will be accepted.

## J. CLEANING UP

1. During the progress of the work, keep the Owner's premises in a neat and orderly condition, free from accumulation of debris resulting from this work. At the completion of the work, remove all material, scrap, etc., which is not a part of this completed project.

## K. OPERATING AND MAINTENANCE INSTRUCTIONS

1. Turn over to the Engineer five (5) sets of marked "as built" drawings, five (5) sets of all equipment catalogs and maintenance data and shop drawings on all equipment requiring same. Explain and demonstrate electrical systems to Owner's representative. Schedule a 2-hour period for this purpose for each site; scheduled dates and times are to be agreeable with the Engineer.

## L. TEMPORARY SYSTEMS

1. The electrical contractor shall be responsible for furnishing and installing equipment and materials necessary for providing electrical power where needed for the construction of the project. All temporary wiring shall be installed so as not to interfere with the new construction, shall be installed in a safe and approved manner, and shall be removed at the completion of the project.
2. Temporary service shall be provided by this Contractor as a central point at the work location to supply the needs of the various trades. This Contractor shall also provide adequate construction lighting as required by Local, State, and Federal regulations.
3. It shall be the responsibility of the electrical contractor to visit the site prior to submitting bids and thoroughly review all existing conditions affecting temporary systems.

## M. GUARANTEE

1. Guarantee that all work executed under this Section 6 will be free from defects of workmanship and materials for a period of one year from date of final acceptance of this work. Promptly repair, replace, or otherwise make good, upon notification, any defect becoming apparent during this period, at no cost to the Owner.

## N. CERTIFICATION

1. Upon completion of the job, after final checkout, the Contractor shall submit a letter, signed by the responsible person, certifying that all of the electrical and control systems have been checked out; that is, each and every operating item and control function has been observed to operate correctly, that every phase of control has been made to operate fully, and that each and every safety control has been made to operate properly. This certification shall be sent to the Engineer. Final payment will not be made until this certification has been submitted and approved.

## 1.02 ELECTRICAL MATERIALS

### A. GENERAL

1. This section includes all basic materials listed in paragraphs 2.01.B.4 and 2.01.D.1, and for raceways, fittings, device boxes, conductors, etc., as required for a complete installation.
2. All materials shall be new and listed by Underwriters Laboratories as conforming to these standards.

3. Material substitutions will be considered only when evidence of equality and suitability, satisfactory to the Engineer, has been presented in writing, with samples if requested by the Engineer.
4. It shall be understood that the Engineer has the authority to reject any material or equipment used which is not specified or approved, or showing defects of manufacture or workmanship, before or after such material or equipment is installed.

#### B. CONDUITS

1. Rigid Steel: To be installed in all exterior locations. To be mild steel piping, galvanized inside and outside, and conform to ASA Specification 080.1 and Underwriter's Laboratories Specifications. By Sprang, Republic, Wheatland, Triangle, Pittsburgh, or equal.
2. Intermediate Metal Conduit (IMC): May be installed inside the buildings only (above 8" AFF). Shall be hot dipped galvanized inside and outside, and manufactured in accordance with U.L. Standard #6 or #1242. By Allied or equal.
3. PVC: May be used for underground installation or within concrete slab, in straight runs only; all bends and elbows shall be rigid steel conduit. PVC is to be of high impact Schedule 40 materials and shall conform to Underwriter's Laboratory Standard UL-651. By Pittsburgh, R.G. Sloan, Carlon, or equal.

#### C. COUPLINGS AND CONNECTORS

1. Rigid and IMC: By Raco, Efcor, Republic, Appleton, or equal.
2. PVC: To be of high impact PVC Schedule 40. Joints to be made with PVC solvent cement as recommended by manufacturer. By Pittsburgh, R.G. Sloan, Carlon, or equal.

#### D. BUSHINGS

1. All rigid bushings 1-1/4" and larger shall be the insulating type. All other bushings shall be OZ Mfg. Co., Type B, Efcor, Type 55, or equal insulated metallic type.

#### E. CONDUIT ACCESSORIES

1. Conduit clamps and supports by Efcor, Steel City, G.A. Tinnerman, or equal. Conduit fittings by Pyle-National, Crouse-Hinds, Appleton, or equal.

#### F. JUNCTION BOXES (Through 4-11/16")

1. Sheet Metal: To be standard type with knockouts made of hot dipped galvanized steel. By Steel City, Raco, Appleton, or equal.
2. Cast: To be type FS, FD, JB, GS, or SEH as required for application.

#### G. JUNCTION AND PULL BOXES (Larger than 4-11/16")

1. To be cast metal for all below grade and exterior use and where indicated on drawings. All shall be oil tight and not less than 16 gauge, Hoffman Type "CH" Boxes or equal.

#### H. GUTTERS

1. Provide gutter in Electrical Building to eliminate conduit where feasible. Arrange equipment accordingly.
2. Gutters shall be a standard manufacturer's item as manufactured by Square D, or equal. For gutters and all electrical equipment in electrical buildings, install a wood backboard, not less than 3/4" thick, paint 2 coats of gray enamel, and mount all equipment thereon. Conductors serving a gutter shall be extended without reduction in size, for the entire length of the gutter.

#### I. OUTLET BOXES

1. Standard type with knockouts, made of hot dipped galvanized steel.
2. Switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.

#### J. CABLE

1. Conductors for 0-600 volts shall have current carrying capacities of copper as per N.E.C., with Type THHN or THW insulation. By Phelps Dodge, Rome, Simplex, General Cable, Okonite, Anaconda, Southwire, or equal.
2. Cables/conductors serving the pump motors from the panelboards are to be supplied by the pump manufacturer. Contractor shall order the respective cable from the pump motor supplier.
3. Cables/conductors serving the Liquid Level Probe (see 2.04.E.2.A) shall be supplied by the manufacturer. Contractor shall order the respective cable from the Probe supplier (Multi Trode).

#### K. IDENTIFICATION NAMEPLATES

1. Provide and install identification nameplates on all autotransformers, switches, panels, transformers, and branch devices. Nameplates are to

be engraved laminated plastic, minimum size to be 1" x 3", with white letters on black background. Engrave 3/16" high characters. Attach nameplates to equipment with two stainless steel screws. Type, style, and sizes of nameplates shall be submitted to Engineer for approval prior to ordering.

#### L. CONTROL AND SIGNAL WIRE

1. Conductor Type TFF, minimum size #14 copper and fully color coded, shall be used. Conductors shall be by Phelps-Dodge, Anaconda, Rome, General Cable, Southwire, or equal.

#### M. WIRING DEVICES

1. Switches shall be A.C. type spec grade, side wired only, with screw fastener as made by Hubbell, P & S, Sierra, Bryant, Slater, Arrow Hart, or equal.
2. Receptacles shall be spec grade, side wired only, with screw fastener as made by Hubbell, Bryant, P & S, Sierra, Slater, Arrow Hart, or equal.
3. All wiring devices located outdoors shall be NEMA 3R.

#### N. SAFETY SWITCHES

1. Furnish and install safety switches as indicated on the drawings. Switches to be NEMA Heavy Duty type HD and Underwriter's Laboratory listed. Safety switches to be Cutler Hammer, Square D, General Electric, or equal.
2. All safety switches for equipment with remote controls shall be equipped with a control circuit disconnect interlock.
3. All safety switches located outdoors shall be in NEMA 3R enclosures.

#### O. VARIABLE FREQUENCY DRIVES

1. There shall be a variable frequency drive (VFD) controller, as described below, furnished for each pump motor. An acceptable unit is the Eaton AF-5000+ controller, which is a full microprocessor based unit. Any other suppliers wishing to be considered shall submit complete technical information 10 days prior to bidding for the Engineer's review.
2. Variable Frequency Drive (VFD) Enclosure: The enclosure shall be a rigid, free standing NEMA 1 enclosure. The access door shall have a lockable handle and input circuit breaker. The enclosure shall be force ventilated. The architecture of the enclosure shall insure that all high voltage and low voltage components are separated from each other, with the low voltage devices being located in the front of the panel and high voltage equipment (120 V or greater) being located at the rear.

3. The input voltage to the drive shall be three phase, 60 hertz, and voltage as shown on the plans (+5%, -10%). Each drive shall feature internal circuitry which shall be capable of protecting the VFD from AC line disturbances. The requirements for harmonic distribution shall be as stated in IEEE-519. The VFD shall be immune to radio frequency interferences (RFI), and be capable of a 6 cycle ride-thru in the event of power loss. The drives shall be capable of operating in temperatures from 32 degrees F to 104 in a 95% non-condensing humidity environment.
4. Each VFD shall be furnished with a door-mounted microprocessor-based operator's panel which shall contain the capabilities of digital display of setpoints speed in rpm, output in Hz, motor voltage, motor current, and any faults that occur. In addition, the panel shall be capable of starting the VFD, auto restart, select frequencies, status outputs for customer use, and RS 232 port for connection to Owner's SCADA unit.
5. Provide a 3-phase power monitor, with adjustable trip delay, for each VFD on this project. Time-Mark Model C264 or approved equal.
6. VFD's shall be designed in accordance with and provided by the Pump Manufacturer and/or supplier.

#### P. PANELBOARDS

1. Furnish and install circuit breaker panelboards as indicated in the panel schedules and where shown on the drawings. Panelboards shall be of a dead-front safety type equipped with thermal magnetic molded case circuit breakers with frame and trip ratings as shown on the schedule.
2. Circuit breakers shall be quick-make, quick-break, thermal magnetic, trip indicating, and shall have common trip on all multiple breakers. Automatic tripping shall be clearly shown on the breaker handle taking a position between ON and OFF when the breaker is automatically tripped. Connection to the buss shall be bolt on.
3. Buss bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Three-phase, four-wire bussing shall be such that any three adjacent single-pole breakers are individually connected to each of the three different phases in such a manner that two or three-pole breakers can be installed at any location. The buss shall be copper. Main ratings shall be as shown in the panelboard schedule on the drawings.
4. Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type conductor specified.
5. The panel shall have engraved laminated plastic plate on front of panel with

panel name, current rating, voltage rating, and number of phases (in accordance with paragraph 2.02.K).

6. The panelboard buss assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with the National Electrical Code, NEMA, and UL Standards for panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel.
7. Front shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. The directory shall be typed to identify the load fed by each circuit. Fronts shall be of code gauge, full finished steel with rust inhibiting primer and baked-enamel finish.
8. Panelboards shall be listed by Underwriter's Laboratories and bear the UL label. Panelboards shall be rated for use as Service Entrance Equipment where required by the National Electrical Code. Panelboards shall be by Square D or approved equal.

#### Q. EQUIPMENT BACKBOARDS

All electrical equipment in the electrical buildings shall be mounted on wood backboards, not less than 3/4" thick, and painted with paint 2 coats of gray flashproof enamel.

### 1.03 ELECTRICAL DISTRIBUTION SYSTEM – INSTALLATION

#### A. GENERAL

1. This section includes the installation of the complete electrical distribution systems.

#### B. SERVICE ENTRANCE

1. It shall be the responsibility of this Contractor to verify with COLUMBIA COUNTY that the location, arrangement, voltage, phase and connections to utility services, as well as the required metering equipment, are coordinated with and are in accordance with requirements of COLUMBIA COUNTY. The contract price shall include all costs necessary to meet the requirements of COLUMBIA COUNTY without extra cost to the Owner. Notify Engineer of any changes required before proceeding with work.

## C. GROUNDING

1. All equipment shall be grounded and bonded in accordance with the National Electrical Code. Ground main service to grounding electrode(s) as specified on the Drawings. All ground mediums are to be bonded together. All conduits entering a panelboard shall be bonded together with approved grounding lugs and bare copper wire. All equipment enclosures shall be bonded to the building ground system.

## D. CONDUIT INSTALLATION

1. Where rigid conduits enter boxes, secure conduit in place with approved insulated fittings. Conduit ends shall be carefully plugged during construction. Use of running threads is absolutely prohibited. Conduit shall be joined with approved couplings.
2. Before installing raceways for motors and fixed equipment, check location of motors and equipment connections. Locate and arrange raceways appropriately.
3. Provide Liquidtight flexible metal conduit connections to all motors and/or any equipment which has moving or vibrating parts. Lengths shall be kept to 18" or less.
4. Provide 14 ga. galvanized pull wire in all empty conduits. Label conduits at both ends as to future use. Where conduits end outside the building(s), provide a wood stake to identify location.
5. Conduit shall be cut square and the ends reamed after threading.
6. Fasten conduit securely in place by means of approved conduit clamps, hanger supports, and fasteners. Arrangement and method of fastening all conduit is subject to Engineer's direction and approval.
7. Conduits shall be sized in accordance with National Electrical Code as amended to date, except when size is shown larger on the drawings.

## E. WIRE AND CABLE INSTALLATION

1. All conductors installed on this project are to be stranded; no solid conductors.
2. No conductor shall be smaller than #12 except where so designated on the drawings or hereinafter specified.
3. Joints and splices in wire shall be made with solderless connectors, and covered so that insulation is equal to conductor insulation. Wire nuts shall

not be used.

4. All splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.
5. Both conductors and conduit shall be continuous from breaker to device; no splices shall be permitted on this project.
6. No conductor shall be pulled until conduit is cleaned of all foreign matter.
7. When installing parallel conductors, it is mandatory that all conductors making up the feeder be exactly the same length, the same size and type of conductor with the same insulation. Each group of conductors making up a phase or neutral must be bonded together at both ends in an approved manner.

#### F. FEEDER DESIGNATION

1. Non-ferrous identifying tags or pressure sensitive labels shall be securely fastened to all cables, feeders, and power circuits in panels and at termination of cables. Tags or labels shall be stamped or printed to correspond with markings on drawings so that feeder or cable number and phase can be readily identified.

#### G. CIRCUITS AND BRANCH CIRCUITS

1. Outlets shall be connected to branch circuits as indicated on drawings by circuit number adjacent to outlet symbols, and no more outlets than are indicated shall be connected to a circuit.

#### H. WIRE JOINTS

1. Splices (wire joints) in conductors are not permitted on this project.
2. Connections to motor leads in motor junction boxes shall be made with split bolt connectors torqued to manufacturer's specifications and covered with Scotch #33 or equal electrical tape so as to give insulation equal to conductor insulation.

#### I. OUTLET BOXES INSTALLATION

1. Outlet boxes shall be securely fastened in place.
2. There shall be no more knockouts opened in any outlet box than are actually required.

#### J. ELECTRICALLY POWERED EQUIPMENT AND CONTROLS

1. Provide and install power circuits for all electrically powered equipment and controls.
2. The electrical contractor shall be responsible for providing and installing all controls, hardware, and circuitry necessary to provide a complete operating system as described on the drawings and in the specifications.
3. Where required by the National Electrical Code and/or other applicable Codes or Authorities, and where indicated on the electrical drawings, the electrical contractor shall furnish and install an approved disconnecting means for all electrically powered equipment and/or controllers for such equipment. The location, rating, and enclosure for the disconnecting means shall be as required by the National Electrical Code and/or other applicable Codes or Authorities.
4. The electrical contractor shall be responsible for the installation of all electrical equipment and controls provided by other trades and all supports, bracing, etc. necessary for their installation and shall make all electrical connections.

#### 1.04 CONTROLS :

##### A. DESCRIPTION

1. Work described in this section includes furnishing all labor, materials, equipment, tools, and incidentals required for a complete and operable installation of the instrumentation and controls.
2. In general, the work shall include furnishing and installing all instrumentation, control panels, control stations, appurtenant equipment, and accessories as indicated on the Drawings, and as specified herein, or as required. All conduit and wiring between panels and all field mounted devices shall be furnished and installed under this Specification.
3. It is the intent of this Specification to require a complete and operable installation of the instrumentation and control system. The Contractor shall furnish and install all equipment including any necessary incidentals, whether or not specifically called for or indicated on the Drawings, but necessary for a complete system.

##### B. DESIGN CRITERIA

1. All of the equipment shall be the manufacturer's latest and proven design. Specifications and Drawings call attention to certain features, but do not purport to cover all details of the controls. The completed system shall be compatible with the functions required and the equipment furnished by the

Contractor.

2. All controls for remote electrically operated or motor driven equipment shall be complete, including all necessary auxiliary relays so as to require only wiring and connections to the equipment control circuit.
3. The Drawings and Specifications indicate the energy sources that will be provided. Any other devices necessary to obtain proper operation of the instrument and controls system from these energy sources shall be furnished by the contractor.
4. Components shall be finished to the manufacturer's standard for service intended unless otherwise indicated in the Specifications or on the Drawings.

#### C. COORDINATION

1. It is the responsibility of the Contractor to check what devices are to be furnished with the equipment and to furnish all additional controls necessary to make the systems perform as specified herein.

#### D. PAINTING

1. Equipment shall receive manufacturer's standard coating.

#### E. FUNCTIONAL DESCRIPTION

1. General: Instrumentation and Controls shall be of the electronic type with all signal transmission between controllers, recorders, and instrumentation being accomplished by electrical means. The instrumentation and controls systems shall be capable of satisfactorily performing the functions described below.

2. Pumps:

A) The pumps shall be automatically controlled by Liquid Level Control Devices indicating level in the raw sewage wetwell. The control system shall produce the necessary level signals required for control of the variable frequency drives which control the pumps.

B) Each pump system shall operate from a level control system which shall continuously detect wet well liquid level for controlling the pump system operation. There shall be included capabilities to operate each drive manually. The level system shall be the Multi Trode MTR Liquid Level Relay, manufactured by SARTEK AMERICA, INC.

- 1) The specific equipment shall be the Multi Trode Model 2.5/10-30 (2.5 meters in length, with 10 sensor segments, and 30 meters

of cable length).

2) A pressure transducer (Foxboro Model 821GM-D) shall be provided as shown to produce a 4-20 ma signal that is proportional to back pressure and is capable of 0.2% span and 0.05% repeatability.

3) Provide automatic pump alternation for both pumps,( with capacity for a third pump in the future).

4) Controls shall be designed in accordance with and provided by the Pump Manufacturer and/or supplier.

5) Controls other than that which is specified herein shall be submitted as an Alternate Bid Item.

C) Local Control Station (in electrical building):

1) H-O-A Switch for each Pump.

2) Run Light for each Pump (Green).

3) High Level (Wet Well) Alarm Light (Red).

4) Seal Leak Alarm Light (Red) for each Pump.

5) High Temperature Alarm Light (Red) for each Pump - manual reset.

6) Automatic Alternation of Pumps.

7) Six (6) digit, non-reset, elapsed time meter to indicate the total run time of each pump in "hours" and "tenth of hours."

8) Six (6) digit, non-reset, simultaneous elapsed time meter to indicate the total run time of simultaneous pump operation in "hours" and "tenth of hours."

9) External Globe Lamp and Siren (Federal Signal Corp. Model TMI) (outside building) to indicate high level in wet well.

F. PUSHBUTTON STATIONS, SELECTOR SWITCHES, AND INDICATING LIGHTS

1. Selector switches, and indicating lights shall be heavy duty type of the same NEMA rating and suitable for installation in the NEMA rated panels specified. Indicating lights shall have built-in transformers and 6-V, miniature, bayonet base incandescent lamps and shall be push-to-test type. Contact clocks for pushbutton stations shall contain not less than one SPDT contact. Selector switches shall be of the rotary level type and shall have two or three SPDT contacts as required.

2. Each device shall be identified with a nameplate. Nameplates shall be engraved laminated plastic, minimum size to be 1" X 3" with white letters on black background. Engrave 3/16" high characters. Attach nameplates to equipment with two stainless steel screws. Type, style, and sizes of nameplates shall be submitted to Engineer for approval prior to ordering.

## G. IDENTIFICATION OF CONDUCTORS

1. The system supplier shall submit a proposed detailed system of identification of control and instrumentation conductors using a single major color throughout for certain functions such as hand, auto, alarm, etc. Also, each conductor shall be identified at each terminal end and each junction box. Conductors shall be identified by using self laminating wire and cable markers equal to the Brady B-191 system. Identification system shall be in accordance with industrial standards and practices.

## H. SPECIAL TOOLS

1. The system supplier shall furnish a tool kit containing all size wrenches and other types of tools, which are necessary for assembling, disassembling, aligning, and calibrating the equipment.

## I. FIELD CALIBRATIONS

1. All instrumentation and controls shall be calibrated in the presence of the Engineer in accordance with the range and accuracy specified herein.
2. All instruments and controls shall be calibrated using a standard calibration sheet which has been approved by the Engineer. This calibration sheet shall be filled out identifying the instrument or item to be calibrated and signed with date and initials of the person calibrating the device.

### 1.05 PAYMENT :

No separate payment will be made for work under this Section of the specifications except as set forth in the Bid Schedule. The cost of such work and all costs incidental thereto shall be included in the price bid for the item which the work pertains.



## PUMP STATION CONTROL

### 2.01 GENERAL:

- L. A pump station control panel shall be provided for the pumping station. The control panel shall respond to a multi-sensored probe to automatically start and stop the pump station as well as sound an alarm upon high wetwell levels.
- M. The pump control panel shall be the standard system of the manufacturer as modified for this application. The wet well levels to be used in operation are as shown on the drawings.
- N. Control panels to be manufactured by Quality Controls.

### 2.02 OPERATION REQUIREMENTS

The control panel shall consist of a main circuit breaker, a motor circuit protector, and magnetic starter, for each pump motor, and 15 ampere, 120 volt circuit breakers as required. All pump control operations shall be accomplished by a multi-sensored probe type level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the Alead@ and Alag@ pumps after each pumping cycle.

### 2.03 LEVEL CONTROL SYSTEM

The level control system shall be Multi Trode type or approved equal, comprising a multi-sensored probe in conjunction with a Multi Trode controller. Systems utilizing multiple probe devices, bubbler type, mercury float, pressure transducer, or ultrasonics, will not be considered equal. The system shall operate using extra low voltage AC as a method of determining liquid level. The level is sensed when the electrical conductivity of the liquid allows a small current to flow, which activates the controller.

- A. Multi-Sensored Level Probe:
  - 1. The exposed surfaces of the multi-sensored probe shall be constructed from premium quality PVC extruded tube and Avesta 254 SMO high grade stainless alloy. Ten sensor points of Avesta 254 SMO are to be equally spaced along the length of the probe assembly with the corresponding, individually numbered control cables accessible in the

attached flexible multi-cored support cable. The flexible probe cable shall be capable of carrying the weight of the probe without the need for additional support and shall be sealed and secured to the tip of the probe by a synthetic rubber compression fitting. The probe shall be pressure injected with an epoxy resin to exceed 2.5m overall length.

2. The probe length shall be as shown on the drawings or as determined by the engineer as appropriate, but in any case not to exceed 2.5m overall length.
  3. The probe shall be suspended, using the stainless steel hook from the stainless steel mounting bracket and cleaning squeegee, positioned at an appropriate place at the top of the wet well. This shall be done in accordance with the manufacturer=s installation instructions.
  4. The probe cable shall be routed from the wet well to the control panel via a separate dedicated conduit.
- B. Multi Trode MTPC 2.1 Duplex Pump Controller: The panel mounted pump controller shall operated in conjunction with the multi-sensored probe by providing extra low voltage AC (12 VAC, 0.8mA. max.) via the numbered probe cables. It shall be capable of controlling and monitoring 2 pumps and 1 alarm by activating the pump starters and alarm devices. The pump controller shall incorporate a front LED indicator panel to monitor status and a keypad to facilitate changes, resets and manual operation of the station.
- C. Indicator Panel: The front panel of the MTPC 2.1 shall include LED indicators for display and keypad switches to operate or control the following:
1. Pump Run
  2. Manual/Off/Automatic
  3. Pump Alternation (duty mode)
  4. Next Pump
  5. Level alarm (Hi or Low)
  6. Alarm status (Latch or automatic reset)
  7. Pump start delay (on/off)
- D. Dipswitches will be provided to select the following program functions:
1. Probe sensitivity
  2. Charge or discharge mode
  3. Level alarm - high or low

- E. The pump controller shall be mounted on the internal hinged door of the electrical control panel for the pump station and wire in accordance with the manufacturer's installation and operating instructions.

#### 2.04 CONSTRUCTION

The electrical control equipment shall be mounted within a NEMA type 3R dead front enclosure, constructed of not less than 14 gauge Type 304 stainless steel. The enclosure shall be equipped with a door and shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Enclosure shall be equipped with stainless steel driplip.

#### 2.05 COMPONENTS

- A. All motor branch circuit breakers and motor starters shall be of highest industrial quality, and securely fastened to the removable back panels with screws and washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
- B. An open frame, across-the-line, NEMA rated, thermal-magnetic motor starter, as manufactured by Square D, shall be furnished for each pump motor. All motor starters shall be equipped to provide overload protection on all phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position.
- C. A duplex, 15 amp, GFI utility receptacle providing 120 volts, 60 hertz, single phase power shall be mounted inside of the enclosure.

#### 2.06 OPERATING CONTROLS AND INSTRUMENTS

- A. All operating controls and instruments shall be securely mounted on the control compartment door. All controls and instruments shall be clearly labeled to indicate function.
- B. A six digit, non-reset elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in Hours@ and Tenths of hours@.
- C. Control terminal blocks shall be of the screw clamp type, rated 600 volts.

- D. Phase monitors: 230 volt, 3 phase stations shall be equipped with an 11 pin model with two Form AC@ contacts, 10 amp rated, as manufacturer by Diversified Electronics.
- E. Control wiring shall be minimum 18AWG, UL#1015. All control wire shall be routed through plastic wireway with snap on covers and be neatly bundled and tie wrapped to form a neat assembly.
- F. Engraved nameplates shall be supplied for marking all components. The labels shall be attached with a 5 mil thick, 3M type adhesive. No foam tape will be acceptable. The labels shall be uniform in size with 1/4" minimum letter size.
- G. The panel shall contain a remote alarm terminal strip to monitor Hi-level.
- H. All circuit breakers are to show through the deadfront door.

## 2.07 ELECTRICAL MATERIALS

### A. GENERAL

1. This section includes all basic materials listed in paragraphs 1.01.B.4 and 1.01.D.1, and for raceways, fittings, device boxes, conductors, etc., as required for a complete installation.
2. All materials shall be new and listed by Underwriters Laboratories as conforming to these standards.
3. Material substitutions will be considered only when evidence of equality and suitability, satisfactory to the Engineer, has been presented in writing, with samples if requested by the Engineer.
4. It shall be understood that the Engineer has the authority to reject any material or equipment used which is not specified or approved, or showing defects of manufacture or workmanship, before or after such material or equipment is installed.

### B. CONDUITS

1. Rigid Steel: To be installed in all exterior locations. To be mild steel piping, galvanized inside and outside, and conform to ASA Specification 080.1 and Underwriter's Laboratories Specifications. By Sprang, Republic, Wheatland, Triangle, Pittsburgh, or equal.

2. Intermediate Metal Conduit (IMC): May be installed inside the buildings only (above 8" AFF). Shall be hot dipped galvanized inside and outside, and manufactured in accordance with U.L. Standard #6 or #1242. By Allied or equal.
3. PVC: May be used for underground installation or within concrete slab, in straight runs only; all bends and elbows shall be rigid steel conduit. PVC is to be of high impact Schedule 40 materials and shall conform to Underwriter's Laboratory Standard UL-651. By Pittsburgh, R.G. Sloan, Carlon, or equal.

#### C. COUPLINGS AND CONNECTORS

1. Rigid and IMC: By Racor, Efcor, Republic, Appleton, or equal.
2. PVC: To be of high impact PVC Schedule 40. Joints to be made with PVC solvent cement as recommended by manufacturer. By Pittsburgh, R.G. Sloan, Carlon, or equal.

#### D. BUSHINGS

1. All rigid bushings 1-1/4" and larger shall be the insulating type. All other bushings shall be OZ Mfg. Co., Type B, Efcor, Type 55, or equal insulated metallic type.

#### E. CONDUIT ACCESSORIES

1. Conduit clamps and supports by Efcor, Steel City, G.A. Tinnerman, or equal. Conduit fittings by Pyle-National, Crouse-Hinds, Appleton, or equal.

#### F. JUNCTION BOXES (Through 4-11/16")

1. Sheet Metal: To be standard type with knockouts made of hot dipped galvanized steel. By Steel City, Racor, Appleton, or equal.
2. Cast: To be type FS, FD, JB, GS, or SEH as required for application.

#### G. JUNCTION AND PULL BOXES (Larger than 4-11/16")

1. To be cast metal for all below grade and exterior use and where indicated on drawings. All shall be oil tight and not less than 16 gauge, Hoffman Type "CH" Boxes or equal.

#### H. GUTTERS

1. Provide gutter in Electrical Building to eliminate conduit where feasible. Arrange equipment accordingly.
2. Gutters shall be a standard manufacturer's item as manufactured by Square D, or equal. For gutters and all electrical equipment in electrical buildings, install a wood backboard, not less than 3/4" thick, paint 2 coats of gray enamel, and mount all equipment thereon. Conductors serving a gutter shall be extended without reduction in size, for the entire length of the gutter.

#### I. OUTLET BOXES

1. Standard type with knockouts, made of hot dipped galvanized steel.
2. Switch and receptacle boxes shall be 4" square for single gang installation. Appropriate gang boxes shall be used for mounting ganged switches.

#### J. CABLE

1. Conductors for 0-600 volts shall have current carrying capacities of copper as per N.E.C., with Type THHN or THW insulation. By Phelps Dodge, Rome, Simplex, General Cable, Okonite, Anaconda, Southwire, or equal.
2. Cables/conductors serving the pump motors from the panelboards are to be supplied by the pump manufacturer. Contractor shall order the respective cable from the pump motor supplier.
3. Cables/conductors serving the Liquid Level Probe (see Section 6.04.E.2.A) shall be supplied by the manufacturer. Contractor shall order the respective cable from the Probe supplier (Multi Trode).

#### K. IDENTIFICATION NAMEPLATES

1. Provide and install identification nameplates on all variable frequency drives, switches, panels, transformers, and branch devices. Nameplates are to be engraved laminated plastic, minimum size to be 1" x 3", with white letters on black background. Engrave 3/16" high characters. Attach nameplates to equipment with two stainless steel screws. Type, style, and sizes of nameplates shall be submitted to Engineer for approval prior to ordering.

#### L. CONTROL AND SIGNAL WIRE

1. Conductor Type TFF, minimum size #14 copper and fully color coded, shall be used. Conductors shall be by Phelps-Dodge, Anaconda, Rome, General Cable, Southwire, or equal.

#### M. WIRING DEVICES

1. Switches shall be A.C. type spec grade, side wired only, with screw fastener as made by Hubbell, P & S, Sierra, Bryant, Slater, Arrow Hart, or equal.
2. Receptacles shall be spec grade, side wired only, with screw fastener as made by Hubbell, Bryant, P & S, Sierra, Slater, Arrow Hart, or equal.
3. All wiring devices located outdoors shall be NEMA 3R.

#### N. SAFETY SWITCHES

1. Furnish and install a fused double throw safety switch as indicated on the drawings. Switches to be NEMA Heavy Duty type HD and Underwriter's Laboratory listed. Safety switches to be Cutler Hammer, Square D, General Electric, or equal.
2. All safety switches for equipment with remote controls shall be equipped with a control circuit disconnect interlock.
3. All safety switches located outdoors shall be in NEMA 3R enclosures.

#### O. PANELBOARDS

1. Furnish and install circuit breaker panelboards as indicated in the panel schedules and where shown on the drawings. Panelboards shall be of a dead-front safety type equipped with thermal magnetic molded case circuit breakers with frame and trip ratings as shown on the schedule.
2. Circuit breakers shall be quick-make, quick-break, thermal magnetic, trip indicating, and shall have common trip on all multiple breakers. Automatic tripping shall be clearly shown on the breaker handle taking a position between ON and OFF when the breaker is automatically tripped. Connection to the buss shall be bolt on.
3. Buss bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Three-phase, four-wire

bussing shall be such that any three adjacent single-pole breakers are individually connected to each of the three different phases in such a manner that two or three-pole breakers can be installed at any location. The buss shall be copper. Main ratings shall be as shown in the panelboard schedule on the drawings.

4. Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type conductor specified.
5. The panel shall have engraved laminated plastic plate on front of panel with panel name, current rating, voltage rating, and number of phases (in accordance with paragraph 6.02.K).
6. The panelboard buss assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with the National Electrical Code, NEMA, and UL Standards for panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel.
7. Front shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. The directory shall be typed to identify the load fed by each circuit. Fronts shall be of code gauge, full finished steel with rust inhibiting primer and baked-enamel finish.
8. Panelboards shall be listed by Underwriter's Laboratories and bear the UL label. Panelboards shall be rated for use as Service Entrance Equipment where required by the National Electrical Code. Panelboards shall be by Square D or equal.

#### P. EQUIPMENT BACKBOARDS

All electrical equipment in the electrical building shall be mounted on wood backboards, not less than 3/4" thick, and painted with paint 2 coats of gray enamel.

2.08 Payment

No separate payment will be made for work under this section of the specifications, except as set forth in the Bid Schedule. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

END OF SECTION