SECTION 40 79 81
PUMP MANAGEMENT AND CONTROL SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials, and appurtenances required to deliver and install equipment and services to perform comprehensive pump monitoring and control for wastewater lift station. The comprehensive Pump Monitoring and Control System (PMCS) shall combine fully redundant lift station operation with flexible, configurable behavior. The PMCS shall support any number of pumps based on easily configured level setpoints and shall use a secure, web-based interface to monitor station behavior, adjust parameters, and configure alarms and text messages.

1.02 MEASUREMENT AND PAYMENT

A. No separate payment will be made for work performed under this Section. Include the cost for this work in the lump sum Base Bid Item in Section 00 41 XX.

1.03 RELATED WORK

A. Instrumentation and control work and system architecture, except as specified herein, is included in Division 25 and further defined in the Instrumentation Drawings.

B. Instrumentation and Controls Testing is included in Section 40 61 21.

C. Application Engineering Services are included in Section 25 08 XX.

D. Electrical work is included in Division 26.

1.04 SYSTEM DESCRIPTION

A. The Pump Management and Control System (PMCS) Kit shall be a pre-engineered, pre-fabricated solution including hardware and software for local and remote site monitoring and control, optionally integrated into an existing SCADA system. Custom solutions are not acceptable. The solution shall be a standard, catalogued product of a water and wastewater pumping automation equipment manufacturer regularly engaged in the design and manufacture of such equipment.

B. The Kit shall include the following:

1. Main control panel enclosure

2. Junction box that houses all terminals for field devices and serves to protect primary control equipment from corrosive gases. Junction box shall be connected to the main panel box via a sealable conduit.

3. Two float switches (high and low level)

4. Submersible level transducer with level guard attachment

C. The PMCS main control panel enclosure shall include the following hardware:

1. Siemens S7 1200 PLC with 16-channel DI module(s) and 8-channel AI module(s)

2. Configurable custom controller

3. Telemetry equipment as specified in the TELEMETRY subsection of this document.

4. Prewired relay logic that implements hardwired backup control

5. Uninterruptable power supply

1.05 SUBMITTALS

A. Submit to the Engineer shop drawings of all items and accessories in accordance with the requirements of Section 01 33 23.

B. Submittals from Vendor shall include:

1. Product Data

2. Shop Drawings with the following:
   a. Control panel elevation drawings showing dimensional information
   b. Schematic diagram
   c. Structural descriptions showing:
      1) Enclosure ratings
      2) Other information as required for approval

3. A list of the recommended spare parts along with current price for each item

4. Wiring specification designating appropriate termination of all I/O devices

C. Submittals from Contractor shall include the following Record Documents:

1. Measurement described in Vendor's installation instructions including at minimum:
   a. Levels measured from the bottom of the wet well:
      1) Low-level float
      2) High-level float
      3) Float cable bracket
      4) Top of motors
      5) Lowest influent
   b. Wet well bottom elevation, depth, and diameter.

2. Power and control connection diagram(s) including conduit locations, enclosure penetrations, and all instrumentation

1.06 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI/NEMA ICS 6 – Enclosures for Industrial Controls and Systems

2. NEMA 250 – Enclosures for Electrical Equipment

3. NEMA ICS 2 – Industrial Control Devices, Controllers, and Assemblies

4. NFPA 70 – National Electrical Code

1.07 VENDOR QUALIFICATION

A. Vendor Qualifications: All primary equipment and services specified in this section shall be supplied by a single vendor with experience in automated lift station management for wastewater lift stations. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.08 DEFINITIONS

A. Commission – To verify that the equipment is installed correctly and able to perform the desired functions.

B. PLC – Programmable Logic Controller. A computer that may be programmed to automate electromechanical processes. A PLC may be used at a lift station to start and stop pumps based on station conditions.

C. SCADA – Supervisory Control and Data Acquisition.

D. VENDOR – Supplier of the Pump Management and Control System hardware and software.

E. VFD – Variable Frequency Drive. Electrical power equipment used to drive the motor of a pump and to control the pump’s speed.

1.09 WARRANTY

A. Vendor shall replace, at no cost to owner, any vendor-provided physical equipment or components that fail during first 12 months of licensed service from date of Substantial Completion.

PART 2 PRODUCTS

2.01 VENDORS

A. The comprehensive pump monitoring and control system for wastewater lift stations, as specified in this section, shall be the Lift Station Guardian Kit and associated firmware and software as supplied by Specific Energy, Inc. (www.specificenergy.com), Georgetown, Texas, or Engineer-approved equal.

2.02 GENERAL

A. The equipment shall perform comprehensive pump monitoring and control, including the following:

1. Level control via level transducer and configurable setpoints.

2. Redundant relay-based level control using high and low floats that ensures correct behavior in the event of failure of electronic controllers.

3. Automatic pump alternation.

4. Web-based remote pump monitoring and control, including:
   a. Event logger
   b. History page
   c. Data logger
   d. Historian
   e. Historical data export
   f. Configuration

5. Automatic upgrade of software, including patches, fixes, and security improvements.

6. Text message alarms can be configured on all monitored signals. Advanced callout scheduling functionality ensures the appropriate person(s) are contacted. Owner personnel acknowledge alarms through user interface.

7. High performance monitoring of lift station behavior to track pump health and support preventative maintenance decisions.

8. Automatic lift station maintenance procedures.

9. All monitoring and configuration parameters are also accessible via Modbus.

10. Pump run-time metering.

11. Pump clog detection.

12. Inflow and outflow measurement without flow meter.

13. Intuitive start-up configuration.

B. Station behavior monitoring, parameter adjustments, and text message configuration shall be presented via a secure, web-based, graphical operator interface that is independent of plant's SCADA system.

C. Data Storage

1. The equipment shall transmit operating data to a remote, secure server in a HIPAA-compliant colocation facility to be stored in a historical database.

2. In the case that a connection is lost to the database, the equipment shall store data locally until the connection is reestablished and the data can be resynchronized.

3. The stored data shall be available to view on the web-based, graphical operator interface.

4. The stored data shall be available to download as a comma-separated values (CSV) file.

D. Reporting

1. The equipment shall produce and deliver monthly reports by email to a list of email addresses provided by the Owner.

2.03 EQUIPMENT

A. Vendor shall include the following components:

1. NEMA Type 4 type outdoor enclosure (stainless steel optional)

2. UL 508A rated panel

3. Integrated hydrogen sulfide gas isolation

4. HOA switches on dead front panel

5. Outer door with locking hasp

6. Electrical surge protection

7. Circuit breaker

8. 750 VA 120 VAC UPS

9. High quality terminal blocks with 500 mA fuses on analog terminals

10. Temperature rating: -20°C to +50°C

11. One differential pressure level transducer with weighted bird-cage attachment and 50-foot cable, model LS-10 by Wika

12. Two mercury float switches

13. Four current transmitters

14. Discharge pressure sensor (optional)

15. Physical alarm/flashing light – tied back to high-level float or PLC for further configuration (optional)

B. Vendor does not provide starters, drives and/or pumps with panel.

C. Vendor does not include instruments to measure the following:

1. Flow

2. Seal failure

3. Thermal overload

4. Phase fault

5. Auxiliary power status

2.04 INSTRUMENTATION

A. All wiring to be labelled and neatly arranged in wireways

B. VFDs (if specified on engineering drawings)

1. Contractor shall configure each VFD to accept a discrete signal from the PMCS control panel so that, when this signal is high, the VFD runs at full speed.

2. Contractor shall configure VFDs to communicate digitally with the PMCS control panel using Modbus RTU over an RS-485 serial connection.

C. Pump Motors

1. PMCS shall monitor motor over-temperature and leakage sensors if available.

2. Contractor shall connect each motor's over-temperature and leakage sensors (if available) to the PMCS control panel as discrete inputs according to Vendor's installation instructions.

3. Contractor shall install continuous cables from pumps to PMCS junction box. No splices shall be made in the wiring.

D. Floats

1. Contractor shall furnish and install equipment for mounting floats and level sensor and corresponding cables.

2. Contractor shall provide float mounting bracket with strain relief that supports and holds float cables. Contractor shall install continuous cables from floats to PMCS junction box. No splices shall be made in the wiring. The float bracket shall be 3/8" diameter and fabricated from stainless steel or steel coated for corrosion resistance. The float bracket shall be attached to the access frame with the 300 series stainless steel fasteners. A dielectric spacer shall be installed when bolting to an aluminum access frame.

3. Contractor shall install the two float switches (one Low Level and one High Level) as follows:
   a. The Low Level float switch shall be installed such that it drops in to the "down" position before the pump motors become unsubmerged.
   b. The High Level float switch shall be installed such that it rises into the "up" position before the level reaches the invert of the lowest gravity influent pipe.
   c. Excess cable shall be looped around the hooks on the float cable bracket.

E. Level Sensor

1. Contractor shall install the submersible level transducer provided with the PMCS Kit as follows:
   a. The following steps shall be taken to still the transducer at the bottom of the wet well:
      1) A four- to eight-foot length of 1" PVC pipe shall be strapped to the level-guard attachment on the transducer using stainless steel hose clamps.
      2) The transducer shall be affixed to the PVC such that both the transducer and the end of the PVC rest on the floor of the wet well.
      3) At several points along the length of the PVC, the transducer cable shall be strapped to the pipe using stainless steel hose clamps.
   b. The level transducer shall be installed on the float cable bracket hooks with little to no slack in the cable.
   c. Excess cable shall be looped around the hooks on the float cable bracket.

F. Flow Meter (if specified on engineering drawings)

1. Contractor shall furnish and install flow meter as indicated on plans.

2. Contractor shall configure flow meter to provide both discrete pulse and analog (4-20 mA) flow signals.

3. Flow meter shall be configured to produce several pulses per second at the highest expected flows.

4. Flow meter shall be capable of withstanding full submersion in the event where the vault fills with water.

5. Flow meter shall be provided with a power supply independent of the PMCS control panel.

2.05 TELEMETRY

A. Cellular communications shall be used for the PMCS control panel.

B. All required hardware (e.g., cellular modem, cable, and antenna) shall be provided with the PMCS kit.

C. Vendor shall include cellular connectivity as part of its service.

2.06 SECURITY

A. The secure, web-based, graphical client interface shall include access control policies and procedures including:

1. Unique user ID for each user

2. Password for each user with a system to ensure password strength

3. Certificate based authentication

B. The equipment shall encrypt all communication that extends beyond the Owner's local network.

PART 3 EXECUTION

3.01 INSTALLATION

A. Prior to providing equipment to Contractor, Vendor or Supplier shall individually test each piece of equipment.

B. Contractor shall mount PMCS control panel and junction box at location shown on engineering drawings.

C. Contractor shall furnish and install power wiring from switchboard, panelboard, or local disconnect to PMCS control panel.

D. Contractor shall furnish and install control wiring between field devices and PMCS control panel according to Vendor-provided instruction manual.

E. Instrumentation / communication wiring and power conductors shall not share the same conduit.

F. If VFDs are present at the lift station, Contractor shall furnish and install an RS-485 communication cable, daisy-chained to each VFD cabinet and PMCS control panel.

G. The Contractor shall mount cellular antenna on top of the PMCS control panel enclosure or as shown on engineering drawings, making the connection using antenna cable and connectors provided by Vendor.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall store the PMCS control panel in a clean, dry, and heated space until mounted.

B. Contractor shall protect the PMCS control panel from dirt, water, condensation, construction debris, and traffic.

C. During storage, Contractor shall connect internal space heaters (if specified) with temporary power.

3.03 SUPPORT

A. Vendor shall provide software updates to improve comprehensive pump monitoring and control and add new features for the duration of licensed service.

B. Vendor shall provide an operator training session for a duration of 4 hours after completion of the installation.

C. The first 12 months of off-site maintenance and support shall be included with the original installation.

D. Supervised equipment installation and provision of on-site support services for up to four trips for the duration of licensed service shall be provided by Vendor under separate agreement with Owner if desired by Owner.

E. Subsequent support and maintenance shall be provided by Vendor under separate agreement with Owner if desired by Owner.

3.04 EQUIPMENT AND SERVICE COMMISSIONING

A. Contractor shall provide qualified and trained personnel to inspect the installed equipment to ensure the equipment has been installed properly and in accordance with Vendor's recommendations. Subsequent to a satisfactory installation, Vendor shall remotely configure and commission the equipment and service shall begin.

END OF SECTION

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