Vari-Gage Triplex Control Panel
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1. General

1.1 Scope of Work

The contractor shall furnish, install and place into operation a pump control system designed to operate sewage pumps in a sewage lift station as described herein. The control system shall be designed utilizing the latest proven technology in control design for sewage lift stations. The control system shall be operator and maintenance friendly to ensure ease of system set up and to limit system down time.

The manufacturer of the system shall take responsibility for the proper operation / sequencing of the total pump control system including the VFD's. The pump control system shall be capable of operating pumps and drives in order to convey sewage to the next pump station without causing a sewage over-flow wherever possible regardless of system demands.

The control system shall be comprised of a standard off the shelf microprocessor (programmable logic controllers with custom software shall not be acceptable). The controller shall have a digital readout and a keypad consisting of 6 keys for entering operational settings. The controller shall be capable of accepting a pressure input of 0-35 feet, a current input of 4-20mA DC or a voltage input (field selectable) of 0-10 VDC.
The controller shall be 100% digital. Control adjustments shall be accomplished by direct digital inputs (potentiometers or other analog adjustments shall not be acceptable). The controller shall allow for programming changes and complete level simulation from the front of the control plate. LED indicators shall be lighted and identify the function to be changed as the operator steps through the programming mode. All of the above shall be accomplished from the face of the control plate without codes and keypad sequences. The controller shall have three scaleable 4-20mA DC analog output. All digital outputs from the controller shall be normally open relay contacts rated for 120VAC. The unit shall have an RTU port capable of operating with standard MODBUS Protocols. The unit shall meet all the requirements described in section 3.1 of this specification labeled "Components "- Pump Controller.

The manufacturer of the system shall take single source, unit responsibility for every component contained within the manufacturer's pump control system.

1.2 Design Data

The pump control system shall be capable of operating ___, ___ HP, ___ full load amp (FLA), ___ RPM submersible pumps in a variable speed mode in order to convey sewage to the next Pump Station without causing a sewage over-flow, regardless of system demands. Three Phase Short Circuit Protection shall be supplied as follows: VFD Circuit Breaker (used for each VFD)

The available input power is ___ VAC, __ phase, __ wire, 60 HZ and is supplied from a __ KVA, __ % impedance transformer with a {Delta} {Wye} {Wye grounded} {Other} secondary winding configuration. The pumping system shall be capable of operating in the simplex, duplex or triplex mode. The system controller shall supervise all sequencing, pump combinations, pump speeds, non critical annunciation, system testing, system

monitoring and back-up systems, and overall system status and control.

1.3 Sequence of Operation

At low wet well levels, the lead pump operates alone and maintains adequate flow. As the wet well level increases, the lead pump ramps up to its pre-determined maximum speed. If the wet well level continues to increase after the lead pump reaches its maximum speed, the lag pump will start at its minimum speed and both pumps will operate in parallel to share the load at the minimum speed of the lag pump. Further increase in the wet well level will cause the lead and lag pumps to ramp up to their maximum speed. If the wet well continues to rise a high level alarm will be activated.

On decreasing wet well level, the pump sequence will reverse and the pumps will shut off in reverse starting order. Once the minimum speed of the lag pump has been reached both pumps will run flat at the lag pumps minimum speed untill the lag stop pump level has been reached. The remaining lead pump will adjust its speed according to its minimum and maximum speed level settings. As the wet well level continues to decrease, the lead pump will reduce its speed until it reaches the lead pump minimum speed level and will run flat at the minimum speed until it reaches the lead stop pump level where the lead pump will be stopped.

1.3.1 Primary System Operation

The system shall be designed to produce an outflow from the wet well, in an energy efficient manner, such that the wet well does not overflow. All variable speed driven, equal HP pumps will operate at the same speed for equal loadsharing, minimized energy consumption during parallel operation

1.3.2 Back-Up Systems and Redundancy

Redundancy shall be provided by a Float Backup System. Failure of the pump controller or improper set up of the variable frequency drives will cause the wet well level to rise to the Standby-Float-System on level. The standby float system will lock out all other control and start the pumps as required based on two float switches (1) set for high level start pumps and (1) set for low level stop pumps. Individual test switches for the low level and the high level floats shall be supplied to simulate their action and verify proper system operation.

All available pumps shall sequence on, with the use of adjustable hard wired time delays, in order to keep the wet-well under control. The pumps will sequence off only when the wet-well level reaches the "stop" float.

2. Products

2.1 General

2.1.1 Codes

Electrical equipment, materials and workmanship shall comply with all applicable codes, safety and fire law regulations at the location of the work and shall conform to applicable codes and standards of the organizations listed below.

1. Institute of Electrical and Electronic Engineers. (IEEE)
2. National Electric Code. (NEC)
3. National Electrical Manufacturers Association (NEMA)
4. American National Standards Institute. (ANSI)
5. Underwriters Laboratories. (UL-508 or 913 for intrinsically safe)

2.1.2 Component Standards

All equipment and materials shall be new and shall bear the manufacturers name and trade name. In cases where the standard has been established for the particular material, the material shall be so labeled. The equipment to be furnished shall essentially be the standard product of a manufacturer regularly engaged in the production of the required type of equipment for this type of work and shall be the manufacturers latest approved design. Equipment and material shall be suitably delivered and stored and shall be readily accessible for inspection. All items subject to moisture damage shall be stored in dry spaces. All material and equipment shall be protected against dirt, dust, water and chemical or mechanical injury, vandalism and theft.

2.2 Construction

2.2.1 Enclosure

The described equipment shall be housed in a single NEMA ___ enclosure size shall be approximately ___ high, ___ wide, and ___ deep. Pilot and indicator devices shal be mounted on the hinged inner door.

2.2.2 Hinged Inner Door

The hinged inner door shall be provided fabricated from 5052-H32.080 marine alloy brushed aluminum. It shall be completely removable for ease of service and shall be held closed by at least (2) hand operated 1/4 turn fasteners.

2.2.3 Control Circuit Wiring

Control circuit wiring inside the panel shall be (16) gauge minimum, type MTW or THW, rated for 300 volts. All power wiring shall be rated for 600 volts. Conductors shall be color coded in the same colors throughout the entire panel. Components having numerical or alphabetical references shall have all wiring similarly coded using a standard decal, which shall be placed on the insulation materials within the confines of the enclosure. The decals shall be placed at all wiring terminations for ease of wire identification.

3. Equipment Description

3.1 Pump Controller

The pump controller shall utilize a microprocessor with a digital display to program and alternate up to three (3) pumps in a variable speed mode with high and low level alarms. The controller shall utilize, at a minimum, a 14 bit analog input chip. The controller shall supply three 4-20 mA DC output signal. The 4-20mA DC output signal(s) shall be programmable from the front of the panel.

3.1.A For bubbler sensory input:

Accurate measurement of the liquid level in the sump shall be made by a bubbler type system in which variations by air pressure shall be applied to a solid-state strain gauge type pressure transducer mounted within the controller. Linearity shall be plus or minus 0.1%, repeatability and hysteresis plus or minus 0.15% of full-scale input. Temperature operating range shall be - 10º to 70ºC. The pressure transducer shall convert the reflected pressure into a digital LED display indicating level in feet and tenths of feet.
A key pad and on board circuitry shall control the air compressor and purge solenoid to automatically blow down the bubbler tube at preset intervals of 1-24 hours. An automatic purge shall occur after a power outage. The automatic purge shall be capable of being disabled through a keypad on the front of the panel. The following sequence shall occur during the purge cycle:

(1) Purge LED lights, analog input is frozen. Solenoid output relay closes.
(2) After a one (1) second delay, the compressor and the high pressure solenoid valve are activated.
(3) After ten (10) seconds the compressor is deactivated
(4) After six (6) seconds the isolation solenoid valve is deactivated
(5) After five (5) seconds, the purge LED goes out and the Analog input updates.

3.1.B For submersible level transducer sensory input:

The submersible level transducer shall be specifically designed to meet rigorous environments encountered in level measurement applications. It shall provide repeatable precision depth measurements under the most adverse conditions. This level transducer shall incorporate an isolated diaphragm sensor, which is specifically designed for use with hostile fluids and gases. The sensor will utilize a silicon pressure cell that has been fitted into a stainless steel housing with an integral, compliant stainless steel barrier diaphragm. The sensor assembly shall be housed in a rugged 316SS case. The level transducer shall have a static accuracy of +/-1% FSO BFSL(Full Scale Output, Best Fit Straight Line) and shall be certified intrinsically safe for hazardous locations. Construction shall be of welded 316SS construction.

3.1.C For ultrasonic level transducer sensory input:

The ultrasonic level transducer shall be a corrosion resistant PVC assembly and consist of two part construction. One part shall be the probe itself and the other, housing for the transmitter electronics. The level transducer shall be an ultrasonic design for hostile fluids and gases. The sensor shall operate at 50 kHz, shall be mounted a minimum of 18" above the maximum head height and shall be resistant to condensation on operating surfaces. The sensor shall automatically compensate for temperature over the range of -40º to +60º C. The level transducer shall provide a 4-20mA DC output for the microprocessor controller. The level transducer shall control sensor output power to adjust for optimum echo conditions on commands sent from its monitor and provide excellent noise immunity. The level transducer shall have a minimum accuracy of +/-1.5%

of full scale and a zero dead band area for fast and reliable response.

3.1.2 Pump Controller Operations

Pump-up or pump-down operation and pump inhibit on low level or high level shall be switch selectable within the controller. The controller shall automatically alternate up to three (3) pumps in automatic operation. Alternation schemes shall include" First On First Off" (FOFO), "Last On First Off" (LOFO) and manual operation 1-2-3, 2-3-1 or 3-1-2 and shall be selectable from the front panel of the controller. In duplex operation the third pump shall not alternate but shall be capable of starting or stopping anywhere throughout the control range. The controller shall allow the placement of the third pump to be user-selectable.

3.1.3 Pump Controller Configuration

The duplex controller shall be expandable to three (3) pump operation by selecting three (3) pump operation within the controller. The controller shall be capable of being configured in the following manner:

(1) duplex with standby pump
(2) duplex with jockey pump
(3) full triplex operation

3.2 LED Indicators

The front of the controller shall have six (6) push-buttons for the following functions:
(1) Automatic button with LED indication
(2) Program button with LED indication
(3) Simulate button with LED indication
(4) Step button
(5) Up arrow button for setting values and selecting functions.
(6) Down arrow button for setting values and selecting functions.

3.3 Operator Interface

3.3.1 Front Panel

The front panel of the digital controller shall provide a convenient operator interface for observation of status and programming. The front of the controller shall have twelve (12) LED'S for function identification and three (3) LED'S for mode identification. The LED identification shall be as follows:

FUNCTION IDENTIFICATION		MODE IDENTIFICATION	
(1)	HIGH ALARM	(1)	AUTO
(2)	LOW ALARM	(2)	PROG
(3)	LEAD	(3)	SIM
(4)	LAG 1		
(5)	LAG 2		
(6)	START		
(7)	STOP		
(8)	MIN SPEED		
(9)	MAX SPEED		

(10) ALTERNATE
(11) ALT. TIME
(12) RAMP SPEED

3.3.2 LED Display

A 1/2" high 3-digit digital LED display shall who pump and alarm status and operational information.

3.3.2A During normal operations, the LED display will show wet well level.

3.3.2B During programming or calibration, the LED display will show operational parameters and programmed data. The other twelve LED indicators on the front of the microprocessor controller shall also light during programming or calibration to show the set points being created. Depressing the Program Key and then depressing the Step Key should allow the operator to sequentially view the alarm and operational settings for the system. Changes to these settings shall be accomplished by depressing the up or down arrow keys to increase or decrease the level settings and to adjust other operational settings. The program shall be stored in EEPROM memory, a non- volatile memory, which shall retain the program when the unit is un-powered without the use of batteries.

3.3.3 Diagnostic Test

The controller shall, when power is applied, go through a diagnostic test of the processor and memory and shall light all digital display digits and all LED indicators as part of a diagnostic test and then automatically return to the automatic mode of operation.

3.3.4 Simulation Capabilities

The controller shall provide a simulate key on the front of the controller to simulate the rising and falling of levels to verify the pump and alarm operating points. The simulation shall be accomplished by depressing the simulate key. Arrow UP and DOWN keys shall be provided to simulate the rising or falling level. Holding the arrow key down for a longer time shall cause the levels on the display to change at a faster rate. A "dead man" timer shall automatically return the controller to the automatic mode if no Key button is pressed for three (3) minutes.

3.3.5 Input Power

The input power to the controller shall be 24 volts AC.

3.3.6 Pump Start-up after Power Loss

Upon power up or return from low level or high level lockout, the controller shall stagger the pumps on utilizing cascading ten (10) second intervals to avoid current or hydraulic surges. Pump Start LED'S shall flash during the interval timing and go to a steady state when the pump run contact closes.

3.3.7 Alarm Tripping

The controller shall employ a (5) second delay on both high level and low level alarm conditions to avoid instantaneous nuisance alarm tripping. The high and low level alarm LED'S shall flash when the alarm is activated after the five-second delay.

3.4 Back up Level Sensor

The back up float sensor shall have all time delays and other components inherent in this system shall be "hardwired" and independent of the primary transducer and the pump controller operation. All pump protective relays and sensors shall be "hardwired" into the float back-up system and shall be independent of the pump controller operation. The system shall require only two floats. Both floats shall be supplied and installed by the Contractor at wet well levels as determined by the Consulting Engineer. The float system shall be powered at 120 VAC.

3.5 Communications Port

An independent serial port shall be available for communicating with host computers, other RTU'S, telephone modems, spread spectrum radios, set frequency radios, leased line modems and cellular telephone modems. The controller shall be capable of communicating via MODBUS standard non- proprietary protocol.

3.6 Controller Housing

The entire controller and pressure transmitter shall be totally self-contained in housing. The complete controller and pressure transducer shall be easily removable by unlatching the handle and drawing out the controller and the pressure transducer from the housing. The removing of the controller and the pressure transducer from the housing shall be accomplished without the need for the disconnection of any wires from the housing or tubing from the system transducer. The electrical connections between the control module and the housing shall be made by self-cleaning heavy-duty spring loaded contacts. The controller case shall be 4" high x 4" wide x 6" deep.

3.7 Pneumatic Connections (for Bubbler Systems only)

The pneumatic connection to the pressure transducer shall be made by a pneumatic quick connect fitting. When the controller is drawn out of the housing and the pressure transducer disconnects, the level sensing pressure tube shall close forming an air tight seal to prevent loss of level pressure.

3.8 Inner Door Devices

The following devices shall be operable or viewed through the inner door to prevent operator exposure to live electrical current:

(1) Hand-Off-Auto selector switches to override automatic mode control.
(2) Neon indicator run lights.
(3) Ground fault protected, 115V convenience receptacles.
(4) Running time meters for each pump.
(5) Pump circuit breakers for each pump.
(6) Main circuit breaker, if required.
(7) Manual Transfer with sliding bar mechanical interlock (includes main circuit breaker)
(8) Moisture sensing pilot lights.
(9) Motor over temperature pilot lights.

3.9 Circuit Breakers

All electrical circuits shall be protected by molded case circuit breakers. Each pole of the breaker shall provide inverse time delay overload protection and instantaneous short circuit protection by means of a thermal magnetic element.

The breaker shall be operated by a toggle-type handle and shall have a quick make, quick break switching mechanism that is mechanically trip free from the handle. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual “on” and “off” position. Breakers shall be completely enclosed in a molded case and shall bear the UL label.

Short circuit interrupting duty (14 KAIC minimum) rating for all motor protection circuit breakers shall be applicable for operating conditions. Substitution of fuses to replace circuit breakers is not acceptable. Circuit breakers shall be operable through the inner door to prevent exposing the operator to live power. A padlock provisions shall be provided to lock the circuit breaker in the Off position.

Each pump VFD circuit breaker shall be operated with "through the door" rotary operators.

3.10 Motor Starters

All contactors shall be NEMA, HP rated and bear a U.L. listed label. IEC control will not be accepted due to reduced life expectancy. Minimum short circuit current shall withstand 22,000 symmetrical amps or as indicated on drawings. Mechanical and electrical interlocks will be provided whenever two contactors are connected to any electrical component or motor and the possibility exists for equipment damage or personnel injury. A minimum of 2 (1N.O.-1N.C.) auxiliary contacts shall be provided for each starter or contactor. Overload heaters must be of the bimetallic type and shall be ambient compensated.

3.11 Relays

Relays shall be of the plug-in design and have a transparent, polycarbonate dust cover to protect the contact surfaces from airborn dust and other contaminats. All relays shall have 3PDT contacts and a molded nylon coil rated for continuous duty operation on 24 and 120VAC. Relay contacts shall be rated for 10A at 300VAC with .187 quick connect terminals. Relay sockets shall be of the (.187) eleven (11) blade design and have screw terminals with self-lifting clamps. Terminal identification numbers shall be visible on the sockets

A minimum of three (3) spare mounted and wired relays shall be provided for use during start-up if required.

3.12 Time-Delay Relays

Time-delay relays shall be of the plug-in design and have a dust cover to protect the contact surfaces from airborne dust and other contaminants. Time-delay relays shall operate on 24 or 120VAC and shall have DPDT contacts rated at 10A. The timing function shall incorporate CMOS technology with two selectable timing ranges. The timing ranges shall be (0.06-160 seconds) and (15 seconds-640 minutes). The time-delay relay shall be provided with a red LED for output contact status. Time-delay relays shall be on-delay or off-delay as required. Time-delay relay sockets shall be of the octal design and have screw terminals with self-lifting clamps. Terminal identification numbers shall be provided in the sockets.

A minimum of two (2) spare, mounted and wired relays shall be provided for use during start-up if required.

3.13 Intrinsic Safe Relay (ISR)

The ISR shall be UL and FM approved and designed to interface devices in hazardous locations with equipment in non-hazardous locations. The ISR shall operate from 120VAC and accept a minimum of two (2) inputs from a hazardous area.

3.14 Control Circuit Transformer

Nominal control voltage not to exceed 120V. Control power transformers (CPT) shall be mounted inside the enclosure. Overcurrent protection shall be supplied on both the line and load sides. Line protection for all step-down transformers shall be provided. Transformers to be sized for a minimum of 25% extra capacity under full load conditions. Minimum size shall be 1 KVA. One secondary line shall be grounded for operator safety.

3.15 Alarms

High and Low Level alarms shall be available with a silence push button. On decreasing levels, the alarm condition will automatically reset when the level falls below the high level alarm set point. On increasing level, the low level alarm shall automatically reset when the level rises above the low level alarm set point.

3.16 Hand - Off - Automatic Switch

Standard HOA switches shall be supplied on the inner door for each pump. The switches shall have a minimum dielectric strength of 1000 volts and a minimum insulation resistance of 100 megaohms. The switches shall be AC rated.

3.17 Monitors

3.19.1 Seal Failure Relays

Seals Failure relays providing adjustable resistance sensing circuitry from 0 to 250,000 ohms for each pump shall be supplied. Upon activation, the seal failure relay shall not shut down the pump but shall illuminate a red pilot light located on the inner door that shall correspond to the appropriate pump. The moisture sensing probes shall be supplied and installed in the pumps by the pump manufacturer.

3.19.2 Over Temperature Sensing Relays

Pump over temperature (manual reset) sensors located in the pump motor shall be supplied for each pump. A red pilot light and reset push button for each pump motor shall be supplied and located on the inner door. When activated, the appropriate pilot light shall illuminate and the associated pump shall not be allowed to run, even if the motor cools sufficiently, until the appropriate reset push-button has been reset.

3.18 Pilot Light Indicators

The controller output indicator lights shall be of the long life, solid-state type with a built in ballast resistor and blocking diode for use with 24 VAC or VDC voltages. Pilot lights shall be equipped with 3/16" quick connect

terminals for ease of field replacement. Soldered terminals shall not be acceptable. Other panel lights shall be neon rated for 125 VAC and shall be high brightness lamps with appropriate built-in resistors to assure long life and desired brightness. The lamps shall be self-insulated and capable of operating for a minimum of 25,000 life hours.

3.19 Surge Protection

Line-to-line and line-to-ground protection shall be provided. This protection shall exceed the requirements of ANSI / IEEE standard C62.1-1984 section 8.6.1. and 8.7.3 by a factor of at least 300%. Voltage clamping time shall be less than 5 nanoseconds with a maximum surge current of 30,000A RMS at a clamping voltage 552VAC. Clamping voltage levels shall be specifically sized for the applied system voltage as well as the winding and grounding configuration of the supply transformer. These voltage levels will be chosen to assure minimizing system voltage excursion. One surge arrestor shall be supplied at the incoming service to the control panel.

3.20 Phase Monitor

A phase monitor shall be supplied at the incoming service to the control panel. The phase monitor shall at a minimum, protect against the following conditions:

- overvoltage
- undervoltage
- phase reversal
- phase imbalance
- loss of phase

The phase monitor shall have an integral fault light as well as (1) form-C isolated contact for alarm indication.

3.21 Running Time Meter

A running time meter measuring hours and hundreds of an hour of operation up to 99999.9 shall be provided for each pump. The time meter shall operate from the control voltage of the motor starter. The meter shall incorporate quartz crystal electronics to ensure accurate time recording. The hours shall be displayed with a reliable electro-mechanical wheel indicator to ensure a permanent record of total running time.

3.22 Cooling System

Cooling shall be accomplished with a dual blower air system; due to the possibility of the ambient temperature of the air immediately adjacent to the enclosure exceeding 40°C.

Each blower must produce ___ CFM output, minimum.

3.23 Variable Frequency Drive (VFD)

The manufacturer of the level control system shall also supply the VFD's and take single source, unit responsibility for every component contained within the manufacturer's pump control system. The VFD shall be supplied by EG Controls.

The VFD shall be rated ___ V, ___ HP, ___ Amp minimum. (2req'd.). The VFD shall provide digitally-based speed adjustment of three-phase motors. The adjustable frequency and voltage output shall provide constant volts

per hertz excitation for the motor up to 60 hertz. The VFD shall have a 110% current rating for one minute. The VFD shall be capable of converting incoming three phase, 460V (+10% to - 10%) and 60 hertz (+ hertz) power to a fixed potential dc bus level. The dc voltage shall be inverted by a pulse width modulated (PWM) inverter to an adjustable frequency output. The controller shall maintain displacement power factor at .95 or greater at any speed or load. The VFD shall have a minimum efficiency of 96% at rated load. The VFD converter shall use a diode bridge for conversion of ac to dc. The inverter section shall use transistors as switching devices.

NOTE: Silicon controller rectifiers (SCRs), current source inverters, and paralleling of devices are unacceptable, power devices must be sized accordingly.

The VFD shall operate in an ambient temperature of 0°C to 50°C, for elevations up to 3,300 feet above sea level and humidity of 0 to 95%, noncondensing, noncorrosive.

3.20.1 Control Features

The following standard basic control features shall be provided:

- Start, Stop, Reset and speed control potentiometer.
- Linear independent timed acceleration and deceleration adjustments.
- Output frequency range factory set for 4-60 hertz.
- Frequency stability of 0.5% for 24 hours with voltage regulation of +2% of maximum rated output voltage.
- Digital Operator Keypad for indication of run mode, inverter enabled, low logic power, power on, and protective trip off due to overcurrent, overvoltage, overfrequency, undervoltage, overtemperature and phase loss.
- Motor slip dependent speed regulation.
- Five cycle logic power carry-over during utility loss.
- Fixed extended dwell time at start to maximize motor starting torque.

3.20.2 Protective Features

The following protective features shall be provided for the VFD:

- Electronic overcurrent trip for instantaneous overload protection.
- AC input line undervoltage and phase loss protection.
- Overfrequency protection.
- Overtemperature protection.
- Overvoltage protection.
- Low logic supply protection.
- Electrical isolation between the power and logic circuits, as well as between the 115 Volt ac control power and the static digital sequencing.
- Ability to withstand output terminal line-to-line short circuits without component failure.
- For any protective controller trip an internal fault relay contact shall close for remote indication.

3.20.3 Independent Adjustments

The following standard independent adjustments shall be provided on the Digital Operator Keypad.

- Minimum speed
- Maximum speed

- Acceleration Time
- Deceleration Time
- Low frequency boost
- Volts per hertz
- Stability
- Adjustable current limit

4. Quality Assurance

4.1 Manufacturer Experience

4.1.1. UL Certification

The manufacturer of the control system shall be certified by Underwriters Laboratories (UL) as being a UL 508 listed manufacturing facility and certified to install a serialized label for quality control and insurance liability considerations.

4.1.2 Liability Insurance

The manufacturer of the control system must carry blanket liability insurance of at least ten (10) million dollars.

4.1.3 Experience

The manufacturer of the control system must be able to document ten years of experience in successfully designing and manufacturing similar control systems for wastewater pumping applications.

4.2 Manufacturer Quality Control

The complete control system shall be functionally tested at the manufacturing facility and certified as a complete system to assure proper operation per specification. All components must be mounted with stainless steel hardware.

4.3 Manufacturer Approval

Manufacturers listed in this specification do not constitute approval. All controls must have the capabilities and functions as outlined in the specifications.

5. Submittal Requirements

5.1 Base Bid

The base bid control system shall be the Vari-Gage 3300 system as manufactured by EG Controls Inc. of Jacksonville Florida and represented by: _____.

All bidding contractors shall base their bid on the Vari-Gage 3300 control system. Contract shall be awarded on the base bid control system. Alternative deductive systems will be considered only after contract award and must be specified with any applicable deducts at bid time in order to receive consideration. Bidders submitting alternate quotations shall submit appropriate cut sheets, circuit drawings and a detailed bill of materials with their alternate bid packages. Approval of an alternative system shall be at the sole discretion of the engineer. All equipment and materials shall be new and shall be specifically designed for the function herein.

5.2 Substitutions

The Engineer will consider proposals for substitution of materials, equipment, methods and services only when proposals are accompanied by full and technical data and all other information required by the Engineer for the proposed substitution. Substitution of materials, equipment, methods and/or services is not allowed unless such substitution has been specifically approved by the Engineer.

5.3 Shop Drawing Submittals

5.3.1 Drawing Requirements

All drawings are to be of the computer generated class.

5.3.2 Engineering Approval

The Engineer reserves the right to approve or disapprove any and all equipment based upon his evaluation. Approval for fabrication and installation will be made only after submittal and review of all shop contract documents. The information required for approval shall include the following items and be provided in (8) sets as a minimum:

- Appropriate cut sheets
- Complete electrical schematics detailing the system
- A complete bill of material
- Detailed drawings of the enclosure
- Exploded detail of every control faceplate, light, switch or meter mounted on the exterior of the enclosure.

5.4 Record Documents And Testing

5.4.1 Record Documents

- Eight (8) sets of as built drawings as per Section 5.3.2, items 1 through 5 of this specification are to be supplied depicting “as built” conditions. This submittal is to include any field modifications made by the authorized start-up personnel during installation, start-up or testing.
- Original copy of the final Quality Control report.

- A complete detailed O & M manual specifically prepared for this system. A typical general O & M manual will not be acceptable.

5.4.2 Testing

The control panel shall be thoroughly tested at the factory prior to shipment.

6. Warranties

All guarantees implied or stated by the control system manufacturer shall be passed in full force to the owner.

All components in the specified control system shall carry , at a minimum, comprehensive, parts only, twelve (12) months guarantee against defects in workmanship and material from the date of final inspection and acceptance not to exceed eighteen (18) months from the date of shipment from the manufacturer's facility.

The manufacturer of the control system shall warrant all components in the system for unit responsibility purposes.

7. Equipment Identification

All electrical equipment shall be identified in accordance with these specifications. All identification labels, both within the enclosure and external, shall be laser-screened, laminated Mylar. All control wiring shall be numbered on each termination.

Screw-in type, engraved nameplates or laser-screened laminated Mylar shall be provided to identify all individually mounted push-buttons, rocker switches, lights, meters, disconnect switches, circuit breakers, motor starters, transformers, relays, fuses, phase monitors, surge arrestors and any other equipment for which identification is required for eventual service or replacement. This includes the appropriate equipment within the cabinet. Embossed tape is not acceptable.

A factory ID label shall be installed inside the outer door including the following information:

- Factory Order Number
- Factory Ship Date
- Supply Voltage, Phase and Frequency
- Control Voltage
- Electrical Wiring Diagram Number
- Wire (number of incoming wires)
- Motor HP and Full Load Current

A warning label stating "DANGER - Disconnect all sources of power before opening door" shall be installed on the inner door.

Control switches, indicators and all back panel-mounted components shall be clearly labeled in accordance with the schematic ladder diagram.

8. Execution

8.1 Field Wiring

Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit termination points are not stressed.

8.2 Panel Protection

The pump control panel shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounting lifting angles.

The pump control panel shall be protected at all times. Any damage to the paint shall be carefully repaired using touch up paint that can be identified by the pump control manufacturer.