LSC-C 200 CONSTANT SPEED PUMP CONTROL SPECIFICATION for

STANDARD SPECIFICATION

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1. GENERAL

1.1 Scope

This document examines the specifications for a Pump Control System used to control and monitor the performance of constant speed pumps that will be used to control the wet well level at a Pump Station Facility in the USA.

The purpose of this section is to specify a complete Pump Control System as follows:

The control system shall be comprised of a standard off the shelf microprocessor with user friendly developed standard PLC and Graphical software. The controller shall have a bright color display with active text and graphics, and operate with any type of compatible analog level transmitter. The controller shall be 100% digital. Control adjustments shall be accomplished through color soft touch screen graphical entry points (potentiometers or other analog adjustments shall not be acceptable). The controller shall allow for setpoint changes from the color soft touch screen graphical interface. All of the above shall be accomplished from the microprocessor display without special codes. An integral float backup program, shall be initiated in case of a primary level transmitter failure. Pump alternation sequencing, shall operate in both primary and float back up operation. Pump run times shall be displayed. Both station inflow and outflow, in gallons per minute, shall be calculated and displayed. All operator adjustable setpoints and feature selections shall be accessible through user friendly color soft touch screen graphical displays. All digital outputs from the controller shall be normally open relay contacts rated for 120 VAC. The unit shall meet all the requirements described in the section of this specification labeled " Components "- Pump Controller.

The manufacturer of the system shall take responsibility for the proper operation / sequencing of the total pump control system.

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

The system shall be the LSC-C 200 control system as manufactured by EG Controls, Jacksonville, FL or pre-approved equal.

1.2 Codes And Standards

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.

A. Institute of Electrical and Electronic Engineers. (IEEE)

B. National Electric Code. (NEC)

C. National Electrical Manufactures Association (NEMA)

D. American National Standards Institute. (ANSI)

E. Underwriters Laboratories 508. (UL-508)

2. OPERATIONAL CHARACTERISTICS

Operation of the Pump Station Controller shall be as described in the following paragraphs.

2.1 Design Data

The pump control system shall be capable of operating X, XX HP, XX full load amp (FLA), XXXX RPM Pumps in a constant speed mode in order to convey sewage to the next Pump Station without causing a sewage over-flow, regardless of system demands.

The available input power is XXX VAC, 3 phase, X wire, 60 HZ and is supplied from a __ KVA, __ % impedance transformer with a {Delta} {Wye} {WyEGrounded} {Other} secondary winding configuration.

The pumping system shall be capable of operating in the simplex or duplex mode.

The system controller shall supervise all sequencing, pump combinations, non critical annunciation, system testing, system monitoring and back-up systems, and overall system status and control.

The complete system shall be equal to the LSC-C 200 system as manufactured by EG Controls, Jacksonville, Florida.

A. Sequence Of Operation

At low wet well levels, the lead pump operates alone and maintains adequate flow. As the wet well level continues to rise and reaches the lag pump start level the lag pump will start and work with the lead pump in gaining control of the wet well.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. As the wet well level decreases and the stop lag pump level is reached the lag pump will be stopped. The lead pump will continue to run untill the level decreases sufficiently to reach the stop lead pump level. Once the lead stop pump level has been reached the lead pump will be stopped and the pumps shall alternate.

2.2 Primary System Operation

The system shall be designed to produce an outflow from the wet well, in an efficient manner, to prevent the wet well from overflowing.

2.3 Back-Up System and Redundancy:

a) Float Backup System

Failure of the pump controller transducer 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 four float switches (1) for high level float, (1) for start lag float pump, (1) for start lead float pump and (1) for stop pumps.

- The pumps shall sequence on in a selected time delay manner.
- The pumps will stop when the wet-well level reaches the "stop" pump float level and the pumps shall then alternate.

b) Hand Off Automatic (HOA) Switch for each pump

3. EQUIPMENT DESCRIPTION

3.1 Circuit Breakers

Circuit breakers shall have a quick make and break operator mechanism.

The handle position shall indicate on, off, or tripped.

A padlock provisions shall be provided to lock the circuit breaker in the Off position.

All motor three phase short circuit protection shall have a minimum rating of 14KAIC .

Breakers shall be as manufactured by EATON.

3.2 Motor Control (Starters, Contactors)

Motor control components shall meet the following criteria:

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

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 1N.O. and 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.

Unit shall be manufactured by EATON Corporation.

3.3 Alarm Horn & Beacon

The panel shall have a red/amber alarm beacon and audible horn. The beacon shall be mounted on top of the panel. The alarm beacon shall be rated 120 VAC, 40/60W, and shall illuminate/flash and the audible alarm shall sound to indicate an alarm condition exists.

3.4 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 a minimum of 2PDT 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

3.5 Intrinsic Safe Relay (ISR) for Float Back-Up System

The ISR shall be UL listed and designed to interface with devices in hazardous locations. The ISR shall operate from 24 DC and accept a minimum of four (4) inputs from a hazardous area.

3.6 Seal Failure Relays

Seal 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 activate an alarm that shall be displayed on the graphical screen display. The moisture sensing probes shall be supplied and installed in the pumps by the pump manufacturer.

3.7 Over Temperature Sensing Relays

Pump over temperature (manual reset) sensors located in the pump motor shall be supplied for each pump. When activated, the alarm shall be displayed on the graphical screen display.

3.8 Dry Contacts

Form “C” Dry contacts shall be supplied for power failure, high level alarm and float backup enabled conditions.

3.9 Phase Monitor Relay

A three phase monitoring relay shall be connected to the incoming side of the power input terminals. The unit shall annunciate the status of incoming power and monitor loss of phase, phase reversal, under voltage. A special user-friendly adjustment panel allows the operator to make adjustments to phase imbalance, low and high voltage trip points, individually adjustable trip and restart delays and offers a selectable restart setting.

3.10 Convenience Receptacle

A GFCI convience receptical shall be provided. The unit shall have polarized blades for two (2) or three (3) wire receptacles. The unit shall require a reset after any ground fault interruption.

3.11 Heater with Thermostat

The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.

3.12 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.

One secondary line shall bEGrounded for operator safety.

Transformers shall be manufactured by Eaton.

3.13 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.

3.14 Pump Controller

1. The pump controller shall utilize a microprocessor with a graphical screen display to program and alternate up to two (2) pumps in a constant speed mode with high level alarm. All operator adjustable setpoints and features shall be accessible from the face of the microprocessor through the use of user friendly graphical screen displays.

2. Accurate measurement of the liquid level in the sump shall be made by a compatable analog level transmitter. The transmitter range shall be entered through the graphical screen display.

3. The controller shall automatically alternate up to two (2) pumps in the automatic operation mode. The alternation scheme shall include the capability of selecting either pump 1 or 2 in the lead position without alternation.

4. A lag pump start time delay shall be provided to prevent simultanious pump starts on power up or the restoring of power after a power outage. The lag pump time delay shall be adjustable from a graphical screen display.

5. The controller shall be capable of calculating both input and output flows and shall dynamically display both flows in gallons per minute(GPM). Inflow and outflow shall be calculated at 15 second intervals.

6. The controller shall display the run time hours for both pumps 1 & 2. The timers shall be re-settable, if desired, from the graphical display screen.

7. The controller shall allow for the entry of wet well geometry, through the graphical display screen, for use in the controller's flow calculations.

8. Dry contact outputs for power loss, high level and float enabled alarms shall be supplied with the controller.

9. The following standard alarm conditions shall be provided on the graphical screen display coverd more fully in section: 3.15 of this specification.

    1) Main Screen Text Alarm Alert
    2) Pump 1 Start Fail
    3) Pump 2 Start Fail
    4) Pump 1 Seal Fail
    5) Pump 2 Seal Fail
    6) Pump 1 Overtemp
    7) Pump 2 Overtemp
    8) High Level Alarm
    9) Float Backup Enabled

10. The controller shall be the LSC-C 200 as manufactured by EG Controls of Jacksonville Florida.

3.15 Graphical Operational Screens

The controller, color soft touch Graphical Interface, shall contain the following screens:

3.15.1 Menu Screen:

The Menu Screen shall be comprised of informational and operating screens and Set Up and data entry screens. The menu buttons on the screen shall be clearly

defined an easy to locate. Touching the selected buttons shall call up the selected screen for display.

3.15.2 Main Screen:

The Main Screen shall provide an overview of the pump control systems operational status by graphically depecting the wet well level with wet well transmitter range, lead and lag pump status and configuration, lead and lag pump start and stop setpoints, calculated inflow and ouflow bargraphs, alarms present indication and other digital readouts and display buttons as required to present a clear view of the pump stations operational status.

3.15.3 Pump Status Screens:

The Pump Status Screen shall be designed to give you an up-to-date status of each pump in your pump control system. Each pump status screen shall use icons, vertical and horizontal bargraphs, digital readouts and display buttons to provide wet well level, wet well transmitter range, HOA status, pump configuration, pump run status, pump status, fail reset button, pump lock out button, alarm text, pump run hours, total pump starts, pump starts per hour, pump hours reset pushbutton, pump starts reset pushbutton and station outflow in GPM. In an alarmed condition the pump status screen shall depict, through the use of pop up windows, five alarm conditions, start fail alarm, seal fail alarm, overtemp alarm, overload alarm and excessive pump starts per hour alarm.

3.15.4 Pump Alternation Set Up Screen:

The Pump Alternation Set Up Screen shall allow for automatic alternation selection or manual line up selection. If manual line up selection is selected lead pump selection shall be available and shall be selectable from the alternation screen. Selection for Last On First Off (LOFO) or First On First Off (FOFO) shall be provided and shall be selectable from the screen. If automatic alternation is selected alternate at pumps off, alternate at specific time of day allow for a minimum of two times, alternate every X number of hours shall all be selectable from the alternation screen.

3.15.5 Help Screen

Help Screens shall be selectively provided through out the graphical interface to assist the operators in properly utilizing a particular operational screen.

3.15.6 Test Screen

A system test screen that provides wet well level simulation for the testing of the pumps and system alarms shall be provided. The system test screen shall display and update the simulated wet well level, the actual wet well level, pump line up, pump run status, pump configuration, station inflow and station outflow and all alarm conditions.

3.15.7 Alarm History Screens

An alarm history screen shall be provided. The alarm history screen shall record and display the alarm entry number, the alarm idenification number, alarm message and alarm confirmation. The screen shall display the last eight (8) recorded alarms.

3.15.8 Seal Fail Enable Screen

A Seal Fail Enable Screen shall be provided. The seal fail enable screen shall allow for the enabling or the disabling of the seal fail alarm for the station pumps. The enable selection shall cause an alarm to occur and the pumps to be stopped when a seal fail occurs. The disable selection shall cause an alarm to occur, but the pumps shall continue to run.

3.15.9 Trend Screens

A Trend Screen shall be provided. The trend screen shall be comprised of two (2) real time trend screens. Each trend screen shall shall represent a 60 minute time segement. The screens shall be as follows:

1. Pump Performance Trend Screen
   The pump performance trend screen shall provide for the comparision and evaluation of a station pump's individual performance. When the trend is iniated it shall display the calculated pump discharge flow for the pump that is currently running. Only one pump shall be allowed to trend at any given time. Individual pump performance trends shall be retreivable up too a 30 day period.
2. Wet Well Trend Screen
   The wet well trend screen shall provide for the comparsion and evaluation of a stations over all performance. The wet well trend screen shall trend the wet well inflow and the wet well outflow. The timing and operation of the screen shall be the same as the pump performance screen.

3.15.10 Pump Set Up Screens

A Pump Set Up Screen shall be provided. The pump Set Up screen shall allow for the establishment of operator setpoints for the pumps start level, stop level and maximum starts per hour that each pump may have before an alarm is activated. The setpoints entry shall be accomplished directly from the pump Set Up screen.

3.15.11 Flow Set Up Screen

A Flow Set Up Screen shall be provided. The flow Set Up screen shall allow the operator to select the configuration of the wet well and specify the demensions of the wet well appropriate for the chosen configuration. The information shall be utlized as a part of the flow algorithm used to calculate the stations flow.

A flow bargraph trend minimum setpoint and a flow bargraph trend maximum setpoint, shall be provided on the screen These setpoints shall establish the minimum and maximum flow values that shall be displayed.

3.15.12 Timer Set Up Screen

A Timer Set Up Screen shall be provided. The timer Set Up screen shall at a minimum provide for the following timer adjustments from the Set Up screen:

1. Pump #1 time to wait for run feedback in seconds
2. Pump #2 time to wait for run feedback in seconds
3. Lead pump start delay after lead start level is reached in seconds
4. Lag pump start delay after lag start level is reached in seconds
5. Delay between lead and lag pumps called to run in seconds
6. High level alarm delay in seconds
7. High level alarm reset delay in seconds
8. Low level alarm delay in seconds
9. Low level alarm reset delay in seconds
10. Level transmitter failure delay in seconds
11. Level transmitter failure reset delay in seconds
12. Pump #1 seal fail alarm delay in seconds
13. Pump #2 seal fail alarm delay in seconds
14. Pump #1 overtemp alarm delay in seconds
15. Pump #2 overtemp alarm delay in seconds
16. Phase fail alarm delay in seconds
17. Simulation auto cancel time duration in seconds

3.15.13 PLC Time Set Up Screens

A PLC Time Set Up Screen shall be provided. The PLC time Set Up screen shall allow the operator to specify the the time and date and communicate the information to the PLC. The time shall be provided in hours, minutes and seconds and shall be entered through appropriate box's that shall be provided on the screen. All three values shall be required to be entered into the PLC. The date shall be provide in year, month and day of the month and shall be entered through appropriate box's that shall be provided on the screen. All three values shall be required to be entered into the PLC.

3.15.14 Alarm Set Up Screen

An Alarm Set Up Screen shall be provided. The alarm Set Up screen shall provide for the setting of the level setpoints for the following conditions:

1. High level alarm in feet
2. Low level alarm in feet
3. Level transmitter failure

Entry box's shall be provided on the screen for the alarm setpoint and for the alarm re-setpoint.

3.15.15 Engineer Set Up Screen

An Engineering Set Up Screen shall be provided. The Engineering Set Up screen shall provide for the scaling in engineering units of the level transmitter. Entry box's shall be provided on the screen for the level transmitter's low and high range perameters.

3.15.16 Screen Set Up Screen

An Screen Set Up Screen shall be provided. The screen Set Up screen shall allow for the contrast adjustment of the graphical interface screen to insure maximum viewability.

3.15.17 Power Fail And Restore Screen

A Power fail and Restore Screen shall be provided. The power fail and restore screen shall display the time power failed and the time power was restored during a power outage.

3.16 Pump Controller

A Programmable Logic Controller with the required memory and functional capacity to perform the specified sequence of operation with the scheduled input and output points required in this specification shall be provided.

3.16.1 Hardware Ratings

The hardware ratings shall be as follows

A. Operating Temperature of range of 0 degrees to +55 degrees C
B. Storage Temperature range of minus 40 degrees to +85 degrees C
C. Humidity range of 5 to 95% relative humidity, non-condensing
D. Noise Immunity in compliance to NEMA Standard ICS 2-230
E. Operation Vibration Rating of 5.0 G at 10 to 500 Hz, 0.030 inch peak-to-peak Relay operation 2 G.
F. Input group to backplane isolation and input group to input group isolation: 151 V ac for one second or 2145 V dc for one second
G. Output group to backplane isolation or output group to output group isolation: 1836 V ac for one second or 2596 V dc for one second.

3.16.2 System Configuration:

The Processor System shall include a processor, base unit / power supply, random access erasable-programmable read only memory, input/output modules and communication modules.

A. System Ratings shall be as follows:
   1. Input / Output Capacity capable of supporting up to 128 I/O points (8 I/O modules maximum)
   2. Scan Rate of 1.0 milliseconds per 1K ladder logic program consisting of simple ladder logic and communication servicing.
   3. Programming Instructions: 89
   4. Bit Execution Time (XIC) of .9 microsecond

B. Programming Language shall be Ladder Logic

C. Minimum Programming Instruction Set shall be as follows:

   1. Language Characteristics: Ladder diagram
   2. Logic Operations: AND, OR, XOR, NOT
   3. Register Operations: Store, recall
   4. Math Operations: Addition, subtraction, multiplication, division, square root, matrix operations
   5. Process Control: Proportional-Integral-Derivative

3.16.3 System Processor

1. Process Memory shall be as follows:
   a. Program memory of 14K Words.
   b. Data Logging memory of 48Kbytes and independent of Program memory.

2. Processor Performance shall be as follows:
   a. Capability of controlling up to (16) I/O Modules
   b. Typical Throughput Time of 1.0 k/ms program consisting of simple ladder logic and communications servicing.
   c. Bit Execution Time of less than 0.9 microseconds
   d. Proportional Integral Derivative Control with a 252 microsecond execution time
   e. Offline programming and editing.

3. Processor Features shall be as follows:

   a. Standard RAM Memory Back-up provided through minimum two year lithium battery.
   b. LED indicators for: POWER, RUN, CPU Fault, Forced I/O, Battery Low, Comms
   c. Separate RS-232 channel that supports RS-232 DF1 full-duplex or DF1 half-duplex slave, DH-485, Modbus RTU Slave and ASCII protocols
   d. Real Time Clock through combination Real Time Clock and Memory Module
   e. Mode Switch Positions for Remote, Program and Run
   f. Two analog trim potentiometers built into the controller.

3.16.4 Base Feature

1. Base Features shall be as follows:
   a. Power Supply
      i. Line voltage of 85-265VAC
      ii. Maximum inrush of 25A for 8ms
   b. (12) inputs rated 120VAC
   c. (12) relay outputs
   d. Separate RS-232 channel that supports RS-232 DF1 full-duplex or DF1 half-duplex slave, DH-485, Modbus RTU Slave and ASCII protocols

3.16.5 Discrete Input Modules (Non-Isolated)

1. Features shall be as follows:
   a. Operating voltage of 79 to 132V AC
   b. (16) Non-isolated Inputs
   c. Removable terminal block
   d. Terminal identification diagram one each module
   e. Terminal blocks to have barriers on 3 sides
   f. LEDs to indicate the status of each I/O point
   g. Optical isolation between digital and field circuits
   h. Wiring terminals with self-lifting pressure plates to secure two #14 AWG wires
   i. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

3.16.6 Analog Input Modules

1. Features shall be as follows
   a. (4) input channels per module
   b. Ratings
      i. Current Rating of 0 to 20mA, 4 to 20mA
      ii. Voltage Rating of Plus/Minus 10Vdc, 0 to 10Vdc,
   c. Input Impedance
      i. Current terminal 250 Ohms
      ii. Voltage terminal 220K Ohms
   d. Resolution of 14 bits unipolar; 14 bits plus sign bipolar with 50/60 Hz filter selected.
   e. Overall Accuracy
      i. Current Terminal Rating of Plus or Minus 0.35 percent full scale at 25 degrees C
      ii. Voltage Terminal Rating of Plus or Minus 0.2 percent full scale at 25 degrees C
   f. Non-linearity of plus or minus 0.03 percent of full scale
   g. Repeatability of plus or minus 0.03 percent
   h. Input channel configuration via configuration software screen or the user program
   i. Input Group to Bus Isolation of 500VAC for (1) minute

j. Removable terminal block
k. Terminal identification diagram one each module
l. Terminal blocks to have barriers on 3 sides
m. LEDs to indicate the status of each I/O point
n. Wiring terminals with self-limiting pressure plates to secure two number 14 AWG wires
o. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

3.16.7 Relay Output Modules (Non-Isolated)

1. Features shall be as follows:

   a. Voltage rating of 5 to 265 V as at 63 Hz
   b. (8) Relay outputs
   c. Continuous current rating per point: 2.5 A ac not to exceed 1440 VA for the module Make: 7.5A, Break: 0.75 A @240V ac Make: 15 A, Break 1.5 A @120V ac
   d. Continuous current rating per module: 16 A ac, 8.0A / common
   e. Removable terminal block
   f. Terminal identification diagram on each module
   g. Terminal blocks to have barriers on 3 sides
   h. LEDs to indicate the status of each I/O point
   i. Optical isolation between digital and field circuits
   j. Wiring terminals with self-lifting pressure plates to secure two number 14 AWG wires
   k. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

3.16.8 Communication Interfaces

1. RS-232 Network
   a. Provide and configure a modem through the RS-232 port on the processor to handle SCADA communications.
   b. Support baud rates between 300 and38.4k
   c. Support RTS/CTS/DCD hardware handshake signals
   d. Provide dial-out capability.

The PLC shall be the MicroLogix 1500 as manufactured by Allen Bradley or approved equal.

The operator interface unit shall be compatabible with Allen Bradly MicroLogix 1500 PLC. The system suppler shall submit for approval system graphics depicting the operator access screens for monitoring and control of the Lift Stations as defined herein.

3.17 Data Logging

The control system shall perform two (2) data logging functions.

1. wet well inflow inflow shall be data logged at one minute intervals. Each value shall be time /date stamped and be in delimited format for direct import into Microsoft Excel, Microsoft NotePad, WordPad and Word. Storage duration shall be for a minimum of 226 days.

2. All alarm logging shall be to an alarm file. Each alarm shall have plain text descriptors, time/date stamps, and be in delimited format for direct import into Microsoft Excel, Microsoft NotePad, WordPad and Word. Storage duration shall be for a minimum of 226 days.

Data shall be stored on a 128 MB flash drive. The flash drive shall be removable for direct transfer to a PC via a USB port.

3.18 Primary Level Sensor

The Submersible Pressure 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 transducer shall incorporate an isolated diaphragm sensor which is specifically designed for use with hostile fluids and gasses. 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 316 SS case that provides for a variety of pressure inputs as well as electrical output connections.

It shall have a static accuracy of +/- 1% FSO BFSL:

Construction shall be Welded 316 SS construction.

It shall be Datalogger compatible.

The transducer will be fully temperature compensated.

The Submersible Pressure Transducer shall be manufactured by Keller PSI.

3.19 Back Up Level Sensor

A. Float Sensor

The backup float sensor shall have the following physical characteristics:

- All time delays and other components inherent in this system shall be incorporated within the pump controller.
- The system shall require 4 floats (to be supplied and installed by the Contractor at wet-well levels as determined by the Consulting Engineer).
- The float system shall be powered by 24 VDC.
- Manual reset from float to analog transmitter shall be accomplished through the graphical screen display.

3.20 Enclosure

The graphical screen display and HOA switches shall be mounted on the inner door of the enclosure.

The (maximum) size of the enclosure shall be (XXH x XXW x XXD). The enclosure shall be NEMA type 12 with drip shield which is designed to house electrical and electronic equipment. The enclosure shall be of the type for use outdoors to protect the enclosed equipment against falling rain and the formation of ice on the enclosure.

The material used for construction shall be cold roll steel, with a minimum thickness of 14 gage. All seams shall be continuously welded and the welds will bEGround to present an attractive appearance. Body stiffeners shall be welded into the enclosure to further insure a rigid construction. The integrity of the door seal shall be assured by using an oil-resistant gasket, bonded to the inside of the doors with an oil-resistant adhesive, and held in place by steel retaining strips. The door seal shall be made complete by using a three point latching mechanism, operated by an oil-tight, key-locking handle.

The Enclosure shall be supplied with a painted cold rolled steel floor stand kit.

Enclosure shall be as manufactured by Hoffman Enclosures or approved equal.

4. QUALITY ASSURANCE

4.1 Manufacturer's Experience

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

The manufacturer of the control system must submit documentation verifying at least 10 years of experience in manufacturing constant speed control systems of a similar size and scope.

The manufacturer of the control system must submit to the Consulting Engineer documentation proving experience in successfully designing and manufacturing at least 10 similar systems of a similar scope.

The manufacturer of the control system must carry blanket liability insurance of at least $2 million.

4.2 Manufacturer's Quality Control

The complete control system, shall be functionally tested at the manufacturers facility and certified as a complete system to assure proper operation per specification in order to minimize costly field changes.

All components must be mounted with stainless steel hardware.

4.3 Manufacturer's Approval

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

4.4 UL Approvals

All components that make up the system shall meet UL (Underwritters Labatories) standards and bear a UL label. The system enclosure shall also bear the UL label certifying that the system meets all UL requirements.

5. SUBMITTAL REQUIREMENTS

NOTE: Non adherence to the request for information below, shall be cause for the submittals to be disapproved.

5.1 Base-Bid Approval

The base bid control system shall be the **LSC-C 200** system as manufactured by EG Controls, Jacksonville, Florida. All bidding contractors shall base their bids 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. Bidder must submit along with his bid package appropriate cut sheets, circuit drawings, display screen print-outs, and detailed bill of materials for any alternative control systems. Acceptance of an alternative system is subject to approval of its quality and conformance with established standards. The contractor shall reimburse the engineer for any additional expenses to review the system and pay additional costs associated with use of the alternative system.

5.2 Substitutions

The Engineer will consider proposals for substitution of materials, equipment, methods, and services only when such proposals are accompanied by full and complete 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.

Where the phrase "Or Equal", "Pre-approved", or "Pre-approved equal" occurs in the specification, do not assume that any materials, equipment, methods, or services will be approved as equal unless the item has been specifically pre-approved by the Engineer.

5.3 Shop Drawings

All drawings are to be of "computer generated" class, $8\frac{1}{2}$" X 11"in size, and bound.

All equipment and materials shall be new and shall be specifically designed for the function herein.

Approval for fabrication and installation will be made only after submittal and review of all shop Contract Documents. The minimum information required for approval shall include eight (8) sets of the following.

Computer generated, 3-line electrical diagram of the power and control system.

Complete electrical schematics detailing every wire and connection within the system as well as all field connections.

Bill of material and product data sheets on all high voltage components (>120VAC), drives, switches, and other critical/important components.

Detailed drawings of the enclosure (size, construction, entry/ exit, and mounting).

Exploded detail of every face plate, light, switch or meter mounted on the exterior of the enclosure.

5.4 Record Documents

The following documents shall be provided:

"AS-BUILT" DRAWINGS: 8 sets of "Shop Drawings" are to be supplied and marked in colored ink as depicting "As-built" conditions. These are to include any field modifications made by the authorized start-up personnel during installation, start-up, or testing.

Original copy of the final Q.C. report.

Operation and Maintenance Manuals: the control system manufacturer shall supply a complete and detailed operation and maintenance manual prepared for this system.

6. WARRANTIES

NOTE: All guarantees implied or stated by the control system manufacturer shall be passed in full force to the owner. The manufacturer of the control system shall warrant all components in the system for unit responsibility purposes.

6.1 Components

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

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.

8. EXECUTION

8.1 Field Installation And Start-Up

8.1.1 THE CONTRACTOR

The Contractor shall include in his bid the services of a trained representative for whatever period of time, assuming 1 trip, is required to inspect, start-up, test the control system, and instruct plant personnel in the proper maintenance and operation of such equipment.

8.1.2 THE OWNER

The owner of this equipment shall supply any personnel to assist the start-up crew which are required to oversee or perform actual work if so required by labor/credit contracts. This cost shall be born by the Contractor.

8.1.3 THE MANUFACTURER

Prior to final approval, the manufacturer shall submit a letter certifying that the installation has been tested, and functions as per the plans and specifications.