BSC-V 200
BOOSTER/ELEVATED TANK
PUMP CONTROL SYSTEM
SPECIFICATION
for

STANDARD SPECIFICATION

Produced by: **EG Controls**
11790 Philips Hwy.
Jacksonville, FL 32256

Date Prepared : **3/19/08**

Table of Contents

1. GENERAL

1.1 Scope

This document examines the specifications for a Booster/Elvated Tank Pump Control System used to control and monitor the performance of two (2) Pumps at a pumping station, located somewhere in the USA. The control system shall monitor the tank level of a Water Tank and automatically start and stop pumps based on operator selected start and stop setpoints and control the flow based on an operator entered flow rate.

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 activEGraphics, and operate with any type of compatable 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 PID flow rate and setpoint changes from the color soft touch screen graphical interface. All of the above shall be accomplished from the microprocessor display without the need for special codes. Pump alternation sequencing shall be operator selectable on the alternation screen. Pump run times shall be displayed. All operator adjustable setpoints and feature selections shall be accessable 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 control system shall take complete responsibility for the proper operation and sequencing of the total pump control system.

The manufacturer of the control system shall supply the variable speed drives to insure system uniformity and compatibility.

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 BSC-V 200 Booster/Elevated Tank 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 Booster/Elevated Tank Pump Control System shall be as described in the following paragraphs.

2.1 Design Data

The PID pump control system shall be capable of operating 2, XX HP, XX full load amp (FLA), Pump in a variable speed mode and maintaining a preselected flow rate while filling the Elevated Tank.

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 allow only one pump to run at a time.

The system controller shall supervise all sequencing, 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 BSC-V-200 Booster/Elevated Tank Pump Control System as manufactured by EG Controls, Jacksonville, Florida.

2.2 Primary System Operation

The Pump Control System at the Elevated Tank shall respond to changes in level in the Elevated Tank and shall start and stop a pump based on preselected pump start and stop setpoints selected by the operator and control flow based on a operator selected flow rate. Local annunciation shall be provided as described later in this specification. Local HOA switches for each pump shall be provided to allow for local control should local control become a requirement.

2.3 Sequence of Operation

As the level in the Elevated Tank begins to fall and reaches the start lead pump tank level the lead pump shall be started at a preselected speed chosen by the operator and shall control the flow to the tank.

As the tank level fills and the level in the Elevated Tank rises and reaches the stop lead pump level the pump shall be stopped and the pumps shall alternate.

2.4 Back-Up System and Redundancy:

a) Hand Off Automatic (HOA) Switch for each pump
b) Potentiometer for speed control 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 provision 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 Corporation.

3.2 Motor Control (Starters, Contactors)

Motor control components shall meet the following criteria:

- All contactors shall be NEMA, HP rated and bear a UL 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 1 NO and 1 NC auxiliary contacts shall be provided for each starter or contactor.
- Overload heaters must be of the bi-metallic 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 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.

3.6 Dry Contacts

Form “C” Dry contacts shall be supplied for power failure, high level alarm and VFD.

3.7 Phase Monitor Relay

A three phase monitoring relay shall be connected to the incoming side of the power input terminals. The unit shall have six LED indicators that annunciate the status of incoming power and monitor loss of phase, phase reversal, under voltage, high voltage and phase imbalance. It shall also include a memory that remembers the last 10 types of faults and the order in which they occurred. 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.

3.8 Convenience Receptacle

A GFI 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.

3.9 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.

3.10 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 be grounded for operator safety.

Transformers shall be manufactured by Eaton Corporation.

3.11 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.

3.12 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 PID variable speed mode with Low and High level alarm. All operator adjustable setpoints and features shall be accessable from the face of thEGraphical screen display through the use of user friendly graphical screens.

2. Accurate measurement of the level in the Elevated tank shall be made by a compatable analog level transmitter. The transmitter range shall be entered through thEGraphical 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. Only one pump shall be allowed to run at a time.

4. The controller shall measure and display the run time hours for pump 1 and pump 2. The timers shall be re-settable, if desired, from thEGraphical display screen.

5. The following standard alarm conditions shall be provided on pop up windows on thEGraphical screen display.

    1) Pump 1 Start Fail Alarm
    2) Pump 2 Start Fail Alarm
    2) Pump 1 VFD Fail
    3) Pump 2 VFD Fail
    4) Pump 1 Overtemp
    5) Pump 2 Overtemp
    6) Pump 1 Overload
    7) Pump 2 Overload
    8) High Discharge Alarm
    10) Level Transmitter Fail
    11) Phase Failure
    12) Flow Transmitter Failure
    13) Low Suction
    14) Low Differential
    15) Tank High
    16) Tank Low

6. The controller shall be the BSC-V 200 Booster/Elevated Tank Pump Control System as manufactured by EG Controls of Jacksonville Florida.

3.13 Graphical Operational Screens

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

3.13.1 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 and easy to locate. Touching the selected buttons shall call up the screen selected for display.

3.13.2 Screen Adjustment Screen

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

3.13.3 Help Screens:

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

3.13.4 Main Screen:

The Main Screen shall provide an overview of the pump control systems operational status by graphically depicting a vertical Elevated Tank and digital display with its transmitter range and level clearly depicted, a vertical Flow Graph and digital display shown in gpm, Lead and Lag pump status and configuration, Percent Speed bargraph, PID flow setpoint display, Differential Pressure display, Minimum Speed setting display and interactive buttons that allow you to go to a flow total or flow controller screen. A button allowing you to manually alternate the lead and lag pumps at any time shall be provided. Indication and other digital readouts and display buttons shall be provided, as required, to present a clear view of the pump stations complete operational status.

3.13.5 Pump Status Screen:

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 flow in gpm, flow setpoint in gpm, pump speed, HOA status, pump configuration, pump run status, fail reset button, pump auto operation disable button, alarm text, pump run hours, pump hours reset pushbutton. Interactive buttons shall be provided allowing for quick access to the Menu, Main and other Pump screen without having to use the menu screen for access. In an alarmed condition the pump status screen shall depict, through the use of pop up flashing text, five alarm conditions, Start Fail alarm, VFD fail alarm, Overtemp alarm, Overload alarm and High Discharge alarm.

3.13.6 Pump Alternation Set Up Screens

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 as well. If automatic alternation is selected alternate at pumps off, alternate at specific time of day with a minimum of two times available and alternate every X number of hours shall all be selectable from the alternation screen.

3.13.7 Pump Setpoint 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 minimum and maximum speeds for each pump. Entry of the pump setpoints shall be accomplished directly from the Pump Set Up screen.

3.13.8 Timer Set Up Screen

A Timer Set Up Screen shall be provide and shall at a minimum provide for the following timer adjustments from the Timer 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. High level alarm delay in seconds
4. Low level alarm delay in seconds
5. Level transmitter failure reset delay in seconds
6. Pump #1 overload alarm delay in seconds
7. Pump #2 overload alarm delay in seconds
8. Pump #1 overtemp alarm delay in seconds
9. Pump #2 overtemp alarm delay in seconds
10. Pump 1 VFD fail delay
11. Pump 2 VFD fail delay
12. Elevated tank pump call delay
13. Low suction pressure alarm delay
14. High discharge pressure alarm delay
15. Low differential pressure alarm delay

3.13.9 PLC Time Set Up Screens

A PLC Time Set Up Screen shall be provided and shall allow the operator to specify 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 boxes 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 boxes that shall be provided on the screen. All three values shall be required to be entered into the PLC.

3.13.10 Alarm Set Up Screen

An Alarm Set Up Screen shall be provided and shall provide for the setting of the following conditions:

1. High level alarm in (feet)

2. Low level alarm in (feet)
3. Low Differential Pressure in (PSID)

Entry boxes shall be provided on the screen for the Alarm Setpoint Entry.

3.13.11 Alarm History Screens

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

The screen shall display the time and date the alarm was activated, when it cleared and when it was acknowledged.

3.13.12 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, differential pressure transmitter and flow transmitter. Entry boxes shall be provided on the screen for the parameters.

3.13.13 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.

3.13.14 Flow Control Screen

The Flow control screen shall mimic a single a single loop analog controller. It shall allow an operator to enter a flow setpoint for rate of flow control when in the automatic mode. It shall also allow for a manual selection and manual speed control. Flow, Flow setpoint and pump speed shall be displayed as bargraphs and text. A password protected screen shall allow for PID loop tuning from the graphical display.

3.13.15 Flow Trend Screen

A flow trend screen shall be provided and shall be capable of displaying the real time trending of the pumps discharge flow rate as measured by an external inline flow meter should one be provided.

3.14 Data Logging

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

1. Tank level and Flow rate 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 or 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 or Word. Storage duration shall be for a minimum of 226 days.

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

3.15 Primary Level Sensor

The level transmitter shall be specifically designed to meet the rigorous conditions of it's operational enviroment. It shall be capable of providing repeatable precision depth measurements under the most adverse conditions.

The transducer range shall be appropriate for the tank being measured. Its construction shall be of 316 stainless steel. The transducer shall be temperature compensated and have an accuracy of at least +/- .5% of the calibrated range

A local read out, integral to the transducer, shall be provided. A block and bleed manifold shall be provided with the transducer as well. The signal output from the transducer shall be 4-20 madc.

3.16 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 variable 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 ten (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 **BSC-V 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, $8^1/_2$" 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 Quality Control 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.