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# **DUPLEX 120 VOLT FLOAT CONTROL PANEL**

## **STANDARD SPECIFICATION**

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# 1. General

## 1.1 Scope Of Work

The contractor shall furnish and install a Pump Control System designed to operate two (2) sewage pumps in a duplex mode at a lift station as described herein. The utility power supply at the pump station shall be \_\_\_volts, \_\_\_phase, \_\_\_ wire. The Duplex pump motors shall be rated at \_\_\_ HP, \_\_\_ FLA'S

The control system shall be designed to operate two pumps based on the wet well level monitored by the float type level sensors. Five normally open float level sensors shall be required for automatic operation of the pump station. An alternator shall allowing for two pump selectable alternation shall be supplied. The control panel shall be designed for the float level sensors to operate on 120 VAC to provide the following functions; stop lead pump, start lead pump, stop lag pump, start lag pump and high-level alarm. The panel shall require electromechanical and solid state components for interface with the wet well level sensor to meet the control requirements.

## 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.

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)

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.

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## **2. Products**

### **2.1 Construction**

#### **2.1.1 Enclosure**

Pilot and indicator devices shall be mounted on the inner door of the enclosure.

The (maximum) size of the enclosure shall be (\_\_H X \_\_W X \_\_D). The enclosure shall be NEMA type 3R, with a 3 point latch, which is designed to house electrical and electronic equipment. The enclosure shall be of the type for use outdoors to provide a degree of protection against falling rain; and shall remain undamaged by the formation of ice on the enclosure

The material used for construction shall be galvanized steel with a minimum thickness of 14 gage. All seams shall be continuously welded and the welds will be ground 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.

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

#### **2.1.2 Hinged Inner Door**

The hinged inner door shall be provided fabricated from, 5052-H32.080 marine alloy aluminum. The hinged inner door shall contain cut outs for all circuit breaker toggles. Control switches and indicators shall be labeled and mounted to the hinged inner door to keep operators from entering the live electrical compartment. A warning sign stating "DANGER -- Disconnect all sources of power before opening door" shall be installed on the inner door. It shall be completely removable for ease of service and shall be held closed by at least (2) hand operated 1/4 turn fasteners.

The following items shall be mounted on the inner door:

1. High level light
2. Pump run light
3. Hand-Off-Automatic rocker/toggle switch to select the operating mode for each pump.

#### **2.1.4 Back-panel**

The control system enclosure shall include a removable back-panel.

Components shall be fastened to the back-panel using stainless steel pinhead machine screws. All devices shall be clearly labeled in accordance with the schematic ladder diagram.

### **2.2 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.

All conduit entries shall be sealed to prevent moisture and gas vapors from entering the control system enclosure.

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## **2.3 Float Control Circuitry**

### **2.3.1 120 VAC Float Control**

The Relay control circuit shall provide for the automatic and manual control and alternation of the pumps to maintain a pump down condition of the wet-well. The 120 Volt control system shall sense the wet-well level through remote level sensing float switches. Floats shall be mounted in the wet-well in a manner that precludes anything from obstructing the full travel of the float, including but not limited to the other floats. Five float switches shall include all pumps off level, lead pump on level, lag pump on level, lag 1 pump on level and high level alarm level to control the pumps operation and provide alarms. Terminal blocks shall be provided for each separate float switch connection and other remote devices.

### **2.3.2 Low Level Cut Circuit**

The control panel shall be supplied with a low level cut out circuit to protect the pumps from running should a low wet well level condition exist.

## **3. Components and Features**

### **3.1 Main Line Lugs**

Mainline lugs of the appropriate sizes shall be furnished for connecting the incoming supply power. The lugs shall be suitable for use with aluminum or copper conductors.

### **3.2 Relays**

Relays shall be of the square base plug in type with integral LED indicator lights. All relays shall have a transparent polycarbonate dust cover to protect the contact surfaces from airborne dust and other contaminants. All relays shall have DPDT or 4PDT contacts, as required. Relays shall be rated for continuous duty operation.

Relay contacts shall be rated for 10 amps at 300VAC. Relay sockets shall have screw terminals with self-lifting clamps and terminal identification numbers located at each connection on the relay socket.

### **3.4 Circuit Breakers**

Each pump motor circuit shall be protected by a properly sized q frame molded case circuit breaker. Each pole of these breakers 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 over center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. 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. The minimum interrupting rating of the breaker shall be 10,000 amps at 240 VAC. Pump motor circuit breaker toggle shall be operable through a cutout in the inner door.

### **3.5 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

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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.

### **3.6 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 arrester shall be supplied at the incoming service to the control panel

### **3.7 Seal Fail 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.

### **3.8 Over Temperature Sensing Relays**

Pump over temperature 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.

### **3.9 Anti-condensation Heater**

An Anti-condensation heater with a thermostat shall be provided to control and maintain the internal temperature to prevent condensation inside the control panel.

### **3.10 Operating Mode Switch**

The panel shall have a Hand-Off-Automatic rocker/toggle switch mounted on the inner door to select the operating mode for each pump.

### **3.11 Elapse Time Meters**

A non-re-settable elapse time meter shall be mounted on the inner/outer door to record the accumulated running time for each pump. The elapse time meter shall be rated 24 VAC.

### **3.12 Alarm Horn & Beacon & Silence Pushbutton**

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, 25W, and shall illuminate/flash and the audible alarm shall sound to indicate an alarm condition exists.

The panel shall be supplied with a alarm silence pusbutton located on the exterior of the enclosure. The alarm silence pushbutton shall manually silence the alarm horn.

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### **3.13 Terminal Strip**

The terminal strip shall be mounted on a 45° angle using rail offset brackets to angle up bottom side of terminals from back panel to ease field wiring connections. Rail offset brackets shall be zinc bichromate plated steel. All wiring within the control system enclosure should be installed in wiring duct and terminated at the terminal block

## **4 SUBMITTAL REQUIREMENTS**

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

### **4.2 Base-Bid Approval**

The base bid control system shall be the 120 volt float panel 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. 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.

### **4.3 Substitutions**

It is important for all bidding contractors to note that alternate proposals based on substituted equipment will require pre-qualification by the Consulting Engineer. Prequals must be received by the Consulting Engineer seven (7) days in advance of the bid date. 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. 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.

“Substitution of materials, equipment, methods, and/or services is not allowed unless such substitution has been specifically approved by the Engineer”

### **4.4 Replacement**

In the event a pre-qualified system is installed by the contractor and does not meet the specified intent of this specification with regard to reliability, efficiency, functional capability or other system requirements, the pre-qualified system may be rejected by the Consultant. The system then must be replaced with the EG Controls system originally specified at no cost to the City or the Consulting Engineer. This option may be exercised by the Owner or the Consultant at any time during the project tenure. Project tenure is defined as beginning the date the project bids and ending on the date the system has operated satisfactorily for one year after final acceptance.

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.

### **4.5 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.

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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.

1. Computer generated, 3-line electrical diagram of the power and control system.
2. Complete electrical schematics detailing every wire and connection within the system as well as all field connections.
3. Bill of material and product data sheets on all high voltage components (>120VAC), switches, and other critical/important components.
4. Detailed drawings of the enclosure (size, construction, entry/ exit, and mounting).
5. Exploded detail of every face plate, light, switch or meter mounted on the exterior of the enclosure.

## **4.6 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.

## **5. Quality Assurance**

### **5.1 Manufacturer Experience**

#### **5.1.1 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.

#### **5.1.2 Liability Insurance**

The manufacturer of the control system must carry blanket liability insurance of at least two (2) million dollars.

#### **5.1.3 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.

### **5.2 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.

### **5.3 Manufacturer Approval**

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

## **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 are warranted for defects in material and workmanship for a minimum of twelve (12) months from the dates the control panel is shipped from the manufacturer.

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 engraved nameplates attached with stainless steel machine screws, photo etched, silk screened, or laser-screened laminated mylar. All control wiring shall be numbered on each termination.

Engraved nameplates attached with stainless steel machine screws, photo etching, silk screened, or laser-screened laminated mylar shall be provided to identify all individually mounted push-buttons, rocker switches, lights, meters, circuit breakers, motor starters, transformers, relays, fuses, phase monitors, surge arrester 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 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.



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