

# Criscuolo Engineering, LLC

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Consulting Engineers  
Civil Engineers  
Land Surveyors

Robert A. Criscuolo, P.E., L.S.  
Paul L. Nott, L.S.  
James M. Pretti, Jr., P.E.  
Linda C. Dow, P.E.

Records of:

Associated Surveys  
Charles H. Miller  
George A. Firth

## MEMORANDUM

**To:** Greater New Haven Water Pollution Control Authority  
**From:** James M. Pretti, Jr., P.E.  
**Date:** 4/10/2018  
**Re:** Humphrey St & Mitchell Dr. Pump Station Rehab. Project – Addendum #3  
**CE File No:** 2017.043 & 2017.044  
**cc:** file

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Addendum #3 is the replacement of Section 16490 entirely due to missing pages and minor edits noted in red.

**SECTION 16490****PROCESS INSTRUMENTATION AND CONTROL****PART 1 – GENERAL****1.01. WORK INCLUDED**

The work covered under this section of the specifications includes the furnishing and installing of all instrumentation and control hereinafter specified to perform the intended function at both the Humphrey Street Pump Station and Mitchell Drive Pump Station. The new lift station control panels shall be integrated with the new telemetry/SCADA system (supplied by owner) by the OWNER'S Instrumentation and Control Integrator with the assistance of the Contractor on site and provide the OWNER with graphical interface, monitoring and control as well as provide records of appropriate system transactions.

**1.02 RELATED WORK**

- A. Section 11310 – Wastewater Pumping System
- B. Section 13420 - Instrumentation
- C. Refer to Division 16, Electrical for wiring standards and practices.

**1.03 REFERENCES**

The Pump Control Panels described in this specification are designed and manufactured according to latest revision of the following standards:

- 1. NFPA 70 - National Electrical Code
- 2. CE Compliant
- 3. UL 1449 3rd Edition
- 4. UL 1283 Listed
- 5. NEMA LS1 Compliance

**1.04 SUBMITTAL DRAWINGS**

- A. Descriptive literature and drawings for equipment and systems being furnished under this section shall be included in two submittals for the Humphrey Street Pump Station and two submittals for the Mitchell Drive Pump Station as a maximum. If two submittals are made, the first shall include all primary devices, transmitters, sensors, and field mounted equipment. The second submittal will include the balance of the submittal required. The submittal shall include as a minimum, equipment specifications, dimensional drawings, flow and other calculations, schematic drawings of each and every system within the complete offering, and such other information requested by the Engineer or considered necessary to the proper installation of the equipment. Furnish submittals in a Bound Booklet Form 8.5" X 11". No sheets shall be larger than 8.5" X 11". Foldout larger sheets will not be acceptable. This submittal shall include coordinated information and drawings for all items that the Single Source System Supplier is required to furnish under

this section of the specifications, all in one integrated and coordinated manual. Each item of a submittal shall carry the appropriate title and be indexed against the appropriate specification item.

- B. A quantity of four (4) sets of submittals shall be furnished for the Engineer's approval.

1.04 INSTRUCTION MANUALS

Prior to 65% of the value of job completion, System Supplier shall furnish two (2) copies to the Engineer of all descriptive matter and complete system operation instruction manuals in separate indexed binders coordinated with the equipment that is furnished and installed for approval for each of the two pump stations. System Supplier shall incorporate Engineer's comments and resubmit for approval within 30 days of receipt of Engineer's comments. Once final approval is obtained, System Supplier shall furnish (4) to the Engineer for each of the two pump stations.

1.06 DELIVERY AND HANDLING

The Contractor shall store both control panels warehoused in a dry location until such time as it is mounted and supplied with electrical service. The Contractor shall insure that the pump power and control cords, as well as submersible pressure level transducer and control floats, are protected from submergence until they are properly installed and sealed at both the Humphrey Street and Mitchell Drive Pump Stations.

PART 2 – CONTROL PANEL SPECIFICATIONS (SAME FOR BOTH PUMP STATIONS)

2.01 MANUFACTURER

- A. The quality-establishing brand for the control panels shall be that manufactured by Control Systems, Inc. (CSI) of Jackson, Mississippi (601) 355-8594, or approved equal.
- B. CSI products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 GENERAL DESCRIPTION

- A. The pumps shall be controlled by a Duplex Pump Controller (DC1-2), per Component Specifications. The controller shall be capable of operating with a submersible pressure level transducer with dry contact outputs for All-Stop, Alternating Lead Start and Lag Start during normal operation. In the automatic mode, the Duplex Pump Controller shall receive stop and start commands based upon the level in the station wet well as sensed by the submersible pressure level transducer. On transducer failure the pumps shall cycle between a high level float and a low level float. The Duplex Pump Controller shall be a standard, catalogued product of a water and wastewater automation equipment

manufacturer regularly engaged in the design and manufacture of such equipment for a period of at least fifteen (15) years. The duplex controller shall perform all control functions as specified in Component Specifications section. In addition, provide input indicator and test module with improper input sequence indicator and controls (FT-1), per Component Specifications. The duplex pump controller shall have the following indicators and controls for each pump:

- a. Manual-Off-Automatic selector switch
  - b. Amber "Call" pilot light
  - c. Green "Off" pilot light
  - d. Red "Run" pilot light
  - e. Red "Seal Failure" pilot light
- B. ELECTRIC SERVICE: The panel shall be designed for 120/240 Volt, three-phase, four-wire, 60 Hz power.
- C. The actual motor horsepower and incoming service entrance may differ than that shown on the drawing. In addition, provide a through the deadfront operator mounted on the deadfront door. The operator shall prevent the deadfront door from being opened while the breaker is in the "ON" position.
- D. SERVICE ENTRANCE SURGE PROTECTION DEVICE: Provide a service entrance rated Type 2, AC power distribution Surge Protection Device (SPD), per Component Specifications, designed to protect all types of loads fed from the distribution panels, branch panels and/or individual equipment panels. Units shall be UL listed and shall bear a UL label. Surge Protection Device shall be rated for 120kA per phase and 60kA per mode. Unit shall come complete with a 20 amp, 480 volt circuit breaker for disconnect means.
- E. PHASE MONITOR: Provide a service entrance Power Monitor (PM), per Component Specifications. During power monitor failure, no three phase motors shall be allowed to operate. Phase monitor shall be protected by 1 amp, 480 volt fuses on the primary side.
- F. PUMPS NO.1 & NO.2: Provide a properly sized combination circuit breaker and NEMA rated motor starter for type and size required by the servicing power company and for the motor horsepower being furnished. The actual horsepower may differ than that indicated on drawing. In addition, provide the following additional equipment and controls.
- G. MOTOR MONITOR each motor, complete with 4-20mA output (MM-1 and MM-2) and properly sized Current Transformers (CT), all per Component Specifications. The Motor Monitor shall provide a positive run signal to the duplex controller, monitor proper motor running conditions, indicate motor running time, and motor full load running amperes. In addition, motor monitor shall come complete with either high or low amperes set point for the motor. In the event of low amperes, the motor shall be failed and not be allowed to operate until the failure is acknowledged. Motor running current shall be transferred to the future telemetry equipment for SCADA use.

- H. **DUPLEX ALARM TELEMETRY OPTION:** Provide an Alarm Telemetry system for the Duplex Controller (DCAT), which provides auxiliary normally open relay contact outputs for the following duplex controller alarms: auxiliary alarm, improper sequence, Motor 1 Failure, Motor 2 Failure, Motor 1 Seal Failure, Motor 2 Seal Failure, and High Level. Provide the following features for the integration with the existing SCADA system.
- The control circuitry shall be solid-state and contain an integral power supply with proper surge and over-current protection.
  - Provide an individual Normally Open, Dry-Contact output for each alarm that has a contact rating of 5 Amps @ 120 VAC, resistive.
  - Provide individual LED indicators for each output relay to show when each relay is energized.
- I. **CONTROL RELAYS:** Provide necessary control relays (CR), per Component Specifications, to interface with each pumps running circuit. Pump running signals shall be available for the integration with the existing SCADA system use.
- LEVEL CONTROLS:**
- J. ~~FUTURE EQUIPMENT:~~ Provide needed spacing on the interior dead-front for the ~~future~~ installation ~~and upgrade with~~ of a CSI MPCT6 Level Meter/Controller, and CSI LF101 Line Filter.
- K. **BRANCH CIRCUIT BREAKERS:** Provide the following 120 volt, single-phase branch circuit breakers, as shown on the drawings.
- 20 amp – 1 pole, for Control Power ~~and Alarm Light~~
  - 20 amp – 1 pole, for ~~Future Telemetry~~ SCADA Equipment
  - 20 amp – 1 pole, for SCADA Receptacle
  - 20 amp – 1 pole, for GFCI Duplex Receptacle
  - 20 amp – 1 pole, for SPARE
- MITCHELL DRIVE ONLY ↓
- 20 amp – 1 pole Gen. Block Heater
  - 20 amp – 1 pole Battery Charger
- L. **CONTROL POWER SURGE PROTECTOR:** Provide a single phase, in-line (series) 120 volt, single-phase, 20A continuous power Surge Protection Device (SPD), per Component Specifications, designed to protect all of the loads fed from the control power circuit.
- M. **DUPLEX RECEPTACLE:** Provide a 120V, 15 amp, duplex receptacle mounted on the backplate of the control cabinet for programming and diagnostic equipment use. Receptacle shall come complete with handy box.
- N. **GROUND FAULT INTERRUPTER RECEPTACLE:** Provide a 120 Volt, 15 amp, Duplex GFCI Receptacle mounted on the inside of enclosure for electrical hand tool use.
- O. **INTRUTION ALARM SWITCH:** To be connected into SCADA panel.

## 2.03 CONSTRUCTION

- A. Control cabinet shall be constructed of a minimum 14 gauge, type 304 stainless steel. Seams shall be continuously welded and ground smooth. Provide a seamless foam-in-place gasket to assure water tight and dust tight seal. Provide a rolled lip around three

sides of door and all sides of enclosure opening to exclude liquids and contaminants. Provide an internal 3-point latch and type 316L stainless steel padlocking powerglide handle to assure security and a water-tight seal while still allowing convenient access. Exterior door(s) shall be removable by pulling a stainless steel continuous hinge pin. Enclosure shall have a #4 brushed finish. Enclosure shall be rated NEMA 4X and be manufactured by Hoffman, Stahlin, or approved equal.

- B. Power and control wires shall be stranded copper type MTW. All wiring shall be in covered plastic wireway.
- C. All points necessary for external connection in the control panel whether power or control shall be wired to a terminal strip located at the top or bottom of the enclosure as directed by the engineer. The terminal strip shall be permanently marked with the same designation as the wire connected to it.
- D. Power and control wires shall be marked at both ends using self-adhering wire markers. No two wires having different functions within each control cabinet shall have the same markings.
- E. All circuit breakers, starters, and other control devices mounted within the control cabinet shall be labeled for identification both within the panel and on the wiring schematic with corresponding designations.
- F. Control power shall be 120 Volts and shall be protected by the correctly sized circuit breaker. If required, provide a properly sized control power transformer with primary over current protection.
- G. Each starter shall be provided with overload protection in all three phases and each individual starter shall have phase failure protection.
- H. All selector switches, indicators, and pilot lights shall be identified with an engraved Bakelite nameplate. All selector switches, pilot lights, and control devices shall be visible and operable from the interior deadfront panel. The deadfront panel shall be constructed of anodized aluminum and shall have a continuous aluminum hinge. An anodized aluminum deadfront shall be utilized when the control cabinet is not conducive to exposed controls or as specified on drawings.
- I. All approval drawings shall be prepared per Joint Industrial Conference (J.I.C.) standards for engineers review **prior to any fabrication** of control equipment. The Controller shall be produced by an Underwriters Laboratories, Inc. (U.L.) 508 listed shop. Proof of label availability shall be submitted with approval drawings.
- J. **Under no circumstances will a PLC type control panel be considered equal or acceptable.**
- K. The Controller manufacturer shall provide a written warranty with approval drawings covering all Control materials and parts furnished for a period ending one year after final acceptance of the project. This warranty shall cover all material replacement, all labor, and all travel expenses.
- L. The Controller manufacturer representative shall show satisfactory evidence that he

maintains a fully equipped factory organization capable of furnishing adequate service for the equipment furnished, including replacement parts within a 75-mile radius of the job site. Suppliers employing outside organizations for “ON CALL” service shall not be considered.

- M. Controller manufacturer representative shall have a service department capable to respond in emergency condition twenty-four / seven and three-hundred sixty-five days a year (24/7/365).
- N. The quality-establishing brand for the control panels shall be that manufactured by Control Systems, Inc. of Jackson, Mississippi.

2.04 COMPONENT SPECIFICATIONS

A. SERVICE ENTRANCE SURGE PROTECTION DEVICE (SPD): The SPD shall be mounted in the control panel adjacent to the Main Breaker. The TVSS is connected to the main bus in the panel with conductors of size and of no greater length than indicated in the Surge Protection Device manufacturer’s installation instructions. SPD shall be a Type 2 device ideal for distribution panels, branch panels and critical loads.

- 1. SPD shall provide transient voltage surge suppression and electrical high frequency noise filtering. Unit is designed for parallel connection to the main bus. SPD unit uses selenium cells and metal oxide varistors to achieve its performance. Products using gas tubes, spark gaps, silicon avalanche diodes or other components, which under failed conditions would cause system failure, are not acceptable.
- 2. Manufacturer qualifications: The product of a manufacturer engaged in the commercial design and manufacture of the type of product described herein for a minimum five (5) years.
- 3. Standards: Product complies with the requirements of the following:
  - a. CE Compliant
  - b. UL 1449 3<sup>rd</sup> Edition
  - c. UL 1283 Listed
  - d. NEMA LS1 Compliance
- 4. Operating Voltage: 120/240 volts, 3-phase, 4-wire + ground
- 5. Maximum Continuous Operating Voltage (MCOV): greater than 115 percent of nominal voltage for all products. All suppression filter systems comply with NEMA LS 1.
- 6. Frequency: Operating frequency range of 47 – 64 Hertz.
- 7. Protection Modes: all phases – phase to ground; all phases – phase to neutral; all phases – phase to phase; and neutral to ground.
- 8. Rated Single Pulse Surge Current Capacity: at rated voltage, no less than:

120,000 A Line to Line

60,000 A Line to Neutral  
60,000 A Line to Ground  
60,000 A Neutral to Ground

9. Tested Single Pulse Surge Current Capacity: Filter system is designed to withstand a single pulse surge current up to 150 percent of the design rating and tested at an independent test laboratory. In the absence of testing facilities capable of such testing, testing of individual components or sub-assemblies within a mode is accepted by ANSI C62.41-1991; the testing includes a Category C1 surge test followed by a second Category C1 test. The test results demonstrate the unit does not degrade by more than 10 percent from the initial test.
10. Clamping Voltage: Suppression filter system clamping voltages are in compliance NEMA LS1-1992.
11. High Frequency Filter: EMI-RFI noise rejection or attenuation values comply with test and evaluation procedures of NEMA LS1-1992.
12. Overcurrent Protection: Unit includes coordinated UL 489 or UL 198 listed or recognized overcurrent protection devices; if fuses are used unit incorporates non-encapsulated, field replaceable fuses.
13. Documentation: Provide product data including equipment manual, electrical and mechanical drawings indicated dimensions weights, mounting provisions, connection details and layout diagram, certified tests of UL1449 Listing/Clamp Voltages and NEMA LS1 compliance, certified single pulse surge current capacity testing, and minimum repetitive surge current capacity testing.
14. Status Indicators: Unit has long-life, solid state, externally visible status indicators that monitor the on-line status of each phase of the unit.
15. Warranty: 25-years Unlimited Free Replacement for service entrance Surge Protection Device.
16. Service entrance Surge Protection Device system shall be equal to Joslyn TK- TK-TT120-3Y240 as required for service entrance.

TAG  
SPD

SERVICE  
Service Entrance Surge Protection Device

#### 2.05 PHASE FAILURE/UNBALANCE/UNDER VOLTAGE/REVERSAL RELAY:

Phase monitor shall be designed to protect 3-phase motors regardless of size and for use with 200 – 240 or 425 – 485 VAC, 50 to 60 Hz motors to prevent damage. The unit shall constantly monitor the three phase voltages to detect harmful power line conditions, caused by single phasing, low voltage, phase reversal and voltage unbalance. When a harmful condition is detected, an output relay is deactivated after a trip delay. The output relay shall reactivate after power line conditions return to an acceptable level for the specified Restart Delay. The trip delay shall prevent nuisance tripping due to rapidly fluctuating power line conditions. Phase monitor shall have the following features and functions.



- A. Under Voltage:
  - Trip: -15% of setting for 230V (-10% for 480V)
  - Reset: -12% of setting for 230V (-8% for 480V)
- B. Over Voltage:
  - Trip: -15% of setting for 230V (-10% for 480V)
  - Reset: -12% of setting for 230V (-8% for 480V)
- C. Phase Unbalance:
  - Trip: 7% with 5 second trip delay  
15% with 1 second trip delay
  - Reset: 6%
- D. Trip Delay: 5 seconds (delay is reduced to 1 second if Phase Unbalance is 15% or greater)
- E. Reset Delay: 2 seconds standard (5-60 seconds optional)
- F. Voltage Range: 200V to 240V or 425V to 525V
- G. Output Rating: 10A resistive @ 240VAC  
6A resistive @ 240VAC
- H. Operating Temp: -40°C to +50°C, -38°F to +122°F
- I. Storage Temp: -45°C to +85°C, -47°F to +185°F
- J. Enclosure: Lexan, surface mount
- K. UL and cUL listed

TAG

PM

SERVICE

Electrical System Power Monitor

## 2.06 CONTROL POWER SURGE PROTECTION DEVICE (SPD):

The surge protection device shall be mounted in the control panel in series with the control power circuit. Provide a single-phase, in-line series AC power line surge protector with the following features:

- A. Rated voltage shall be 120 VAC @ 60Hz.
- B. Current rating shall be 20 Amps @ 40°C.
- C. The protection circuitry shall automatically reset after the transient has passed.
- D. Protection modes shall be: Line to Neutral, Line to Ground, and Neutral to Ground.
- E. Provide three (3) Green LED indicators to indicate protection status of each mode when power is present (L-N, L-G, N-G).

- F. Varistors with integral thermally activated elements shall be used to open in the event of overheating due to the abnormal overvoltage, limited current conditions outlined in UL1449. The lower inductance of the varistors shall result in improved clamping performance to fast overvoltage transients.
- G. Metal Oxide Varistors (MOV) shall have cured, flame retardant epoxy polymer coating meeting UL94V-0 requirements.
- H. Electromagnetic Interference (EMI) filtration shall be incorporated into the unit to dampen unwanted signals from the protected side of the unit.
- I. Operating temperature shall be -40 to +70°C.
- J. Screw terminals shall be provided for all wiring.
- K. Maximum continuous operating VAC shall be 115% of rated line voltage.

TAG  
SP

SERVICE  
Control Power Surge Protection Device

## 2.07 DUPLEX PUMP CONTROLLER:

Provide a duplex controller to control two pumps that includes the following control functions.

- A. OPERATORS AND INDICATORS (for each pump)
  - 1. Manual-Off-Automatic selector switch
  - 2. Green "Off" pilot light
  - 3. Red "Run" pilot light
  - 4. Red "Pump Seal Failure" pilot light
- B. A Pump NO. 1 LEAD – ALTERNATE – Pump NO. 2 LEAD sequence selector switch to select either pump as lead pump or to select that the motors alternate as lead pump on each call for cycle.
- C. Signal inputs for: stop, lead pump start, lag pump start, low level alarm and a high level alarm. The sensors shall be optically isolated and operate on 12VDC with a maximum current of 12mA for intrinsic safety.
- D. Pilot light indicators for each level control input, which includes Start and Stop levels and Running inputs for each pump along with a low-level & high-level alarm.
- E. A field adjustable failure time delay for each pump, in the range of five (5) seconds to six and a half (6½) minutes, to start the lag pump at the lead pump start point if the lead pump fails or if the lead pump selector switch is placed in the off position. If a pump fails, the remaining functional pump shall remain the lead pump on future cycles.

The failed pump shall only be called to operate at the lag pump operating point. Normal pump alternation shall resume when failure condition is corrected and pump has been reset.

- F. Soft stop feature to require the motors to stop three (3) seconds apart during the condition that both motors are running when signaled to stop. Soft start feature to require the motors to start three (3) seconds apart during conditions that the lead and lag motors are called for simultaneously.
- G. Individual field adjustable time controls to delay starting each pump in the automatic mode after power failure or during initial startup.
- H. Pump failure, pump seal failure, and low-level & high-level alarm red pilot lights shall flash when activated.
- I. Provide pump running, pump failure and seal failure alarm contacts for each pump. In addition, provide a low-level & high-level alarm contact.
- J. Manual override inputs for each pump, which can be used to manually override the duplex controls', pump outputs when the controls are in the Auto mode. Inputs shall be provided to start or stop each pump from a remote location.
- K. Improper sequence alarm (if required) to activate the common alarm in the event the control level inputs are activated in the wrong order. The order shall be Stop, Lead Start, and Lag Start. The low-level & high-level alarms shall not be included in the improper sequence test.
- L. Provide automatic pump alternation on seal failure when a seal failure condition is detected and the motors are in the automatic mode. The failed pump shall be made the lag pump on future cycles until the failure condition is corrected.
- M. Provide integral Repeat Cycle timing controls for the pump controller, containing the following features:
  - 1. The timer shall enable automatic On/Off control of the motors, based on separate on and off times which are set in either seconds or minutes.
  - 2. The timing ranges shall be 1 to 1023 seconds or minutes depending on the field selectable range used. Independent ranges shall be included for On and Off timing.

TAG

DC1-2

SERVICE

Pump No. 1 & No. 2 Controller

## 2.08 DUPLEX ALARM TELEMETRY OPTION:

Provide an Alarm Telemetry system for the Duplex Controller, which provides auxiliary normally open relay contact outputs for the following duplex controller alarms: auxiliary alarm, improper sequence, Motor 1 Failure, Motor 2 Failure, Motor 1 Seal Failure, Motor 2 Seal Failure, Low Level and High Level. Provide the following features for the DCAT system.

- A. The control circuitry shall be solid-state and contain an integral power supply with proper surge and over-current protection.
- B. Provide an individual Normally Open, Dry-Contact output for each alarm that has a contact rating of 5 Amps @ 120 VAC, resistive.
- C. Provide individual LED indicators for each output relay to show when each relay is energized.

TAG

DCAT

SERVICE

Duplex Alarm Telemetry System

## 2.09 MOTOR MONITOR:

Provide an electronic solid state Motor Monitor with portional 4-20mA output, powered by 120 volt AC that will accept a zero (0) to five (5) amp input signal condition the signal to perform ON/OFF or OPEN/CLOSE discrete dry type setpoint contact conditions based on the input signal value. The Motor Monitor shall have the following features.

- A. Provide an LCD readout meter providing field adjustable scales of 0-25.0, 0-50.0, 0-100.0, 0-250, 0-500 and 0-1000 to accurately indicate the motor full load current using the 0-5 amp input signal.
- B. The Monitor shall be capable of displaying motor total running time up to 99,999.9 hours and be provided with reset capability from the rear of the monitor. The display shall include a non-volatile EEPROM memory backup that does not require battery backup during power failure.
- C. Provide two (2) separate field adjustable setpoints, each with discrete, isolated sealed SPDT relay output contacts. The setting of each setpoint shall be adjustable throughout the complete signal range from the front of the Monitor. Each set point shall be provided with a field adjustable "ON" and "OFF" time delay, adjustable from zero (0) to fifteen (15) seconds. The actual setting of each setpoint shall be able to be displayed on the LCD readout at any time. An LED indicator shall be provided for each setpoint and shall operate as follows:
  - 1. Setpoint No. 1: When setpoint is timing, the indicator shall burn amber. After timing period and current is at or above setpoint, indicator shall burn green.
  - 2. Setpoint No. 2: When set point is timing, the indicator shall burn amber. After set timing period and current is at or above setpoint, indicator shall burn red.
- D. Provide a 4-20mA or a 1-5Vdc output signal which is proportional to the amperes being measured. Load maximum impedance should not exceed 330 ohms. Output signal shall be factory calibrated.

TAG

MM-1

MM-2

SERVICE

Pump No. 1 Motor Monitor

Pump No. 2 Motor Monitor

## 2.10 FLOAT TEST:

Provide input indicator and test module with improper input sequence indicator and controls. The following controls and equipment shall be supplied.

- A. Five deadfront panel mounted input pilot light indicators: One for each of the following level control points Stop, Lead Start, Lag Start and Low Level & High Level alarm.
- B. Five deadfront panel mounted pushbuttons to test each pump level control input.
- C. Automatic input sequence monitoring, such that if the inputs do not occur in proper order (stop, lead start and lag start); a red pilot light indicator shall be activated.
- D. If stop input fails, followed by lead input activation, lead pump shall operate and continue until lead pump input is removed and a field adjustable time delay has expired.
- E. If stop input fails, followed by lead and lag input activation, both motors shall operate and continue until their respective input is removed and an individual field adjustable time delay for each pump has expired.
- F. If stop, lead and lag inputs fail, followed by high level input activation, both motors shall operate and continue until the high level input is removed and a field adjustable time delay for each pump has expired.
- G. Improper sequence activation shall also activate the common external alarm controls.
- H. Improper sequence alarm shall require reset button activation to remove the alarm light.

TAG  
FT-1

SERVICE  
Float Test Module

## 2.11 CONTROL RELAYS:

Provide a SnapTrack channel mounted relay board with LED status indicator and individual quick-connect terminals. The SnapTrack can be optionally snapped to a DIN rail. The indicator LED shall turn on when the relay is energized. The terminals shall be of the fixed screw cage clamp type, rated for at least 10 amps at 250 Volts.

Tubular screw clamp types will not be accepted. The relay shall be rated for 10 amps. Surge suppression shall be provided on the coil side of the relay. The board shall include built-in transient protection across the coil. DC powered versions shall include a built-in diode across the coil to protect external devices from coil surges. The relay and connectors shall be UL approved.

TAG  
CR

SERVICE  
Misc. Pump Control Relays

## 2.12 SPARE PARTS

A one-year supply of manufactures' recommended spare parts shall be provided. The spare parts shall be packaged for long-term storage and shall be protected against humidity and temperature. A spare parts list shall be furnished listing manufacture, device model number, part number, and quantity supplied.

- A. Provide following spare packaged for long-term storage and delivered to owner.

QTY.	MODEL NO.	DESCRIPTION
1	DC101	Duplex Controller

- B. The System Supplier shall maintain an inventory at his facility of at least one part of each type furnished on this project. These parts shall be available for delivery to the owner in a maximum of ten (10) hours.
- C. Wetwell pressure transducer (0-15 ft)

PART 3 – EXECUTION

3.01 ENGINEERING SUPERVISION

- A. The services of a qualified representative of the System Supplier shall be provided to inspect the completed installations at the Humphrey Street and Mitchell Street Pump Stations, suggest all adjustments necessary to place the system in proper operation, and instruct operating personnel in the care and operation of the equipment furnished. A minimum of one (1) day and one (1) trip start-up service and training operating personnel shall be included. The services shall be furnished by the Contractor as a part of the work included under this section of the specifications.
- B. The System Supplier shall show satisfactory evidence that he maintains, a fully equipped factory organization capable of furnishing adequate service for the equipment furnished, included replacement parts. Suppliers employing outside organizations for “ON CALL” service shall not be considered.

3.02 GENERAL INSTALLATION

- A. Installation of instrumentation and controls at both pump stations shall be in strict compliance with the manufacturer's instruction. The locations of these items as shown on the Contract Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. It is the duty of the Contractor to obtain, in the field, all relevant information required for proper placement of instrumentation and controls. In the case of interference with other work, proceed as instructed by the Engineer and provide all materials and labor required to prevent construction delays.
- B. Execution of the installation shall be in full accordance with codes and local rulings. The Contractor shall be responsible for any expenses that are a result of work performed contrary to said codes and regulations.

- C. The System Supplier shall coordinate with the Contractor the installation, the location of process equipment, and connections of process equipment to related equipment panels, subject to the Engineer's approval. The equipment being furnished with electrical controls or instrumentation must be submitted to the System Supplier for approval and coordination with all other control and instrumentation on this project. This engineer will not approve any equipment submittal until this coordination has been accomplished.

END OF SECTION 16490