## SECTION 48

## PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

### 48. 1 GENERAL

This section specifies the electrical power and control system requirements for wastewater pump stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than two (2) pumps are involved except that the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of three (3) years experience in the building of pump control panels.

A pump station control panel shall be provided for each wastewater pump station. (See approved manufacturers list in appendix.) The control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high or low wet well levels. The control panel shall operate two (2) electrical submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be turned off at the elevations shown on the PLANS. Pumps shall alternate positions as lead pump at the end of each cycle. Failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure.

The control panel shall consist of main circuit breakers and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 15 ampere, 120 volt circuit breakers as required. All pump control operations shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

### 48. 2 PANEL CONSTRUCTION

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 Gauge stainless steel enclosure. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel. Door shall be equipped with fast operating clamp assembly fasteners which can be operated without the use of screwdrivers or other tools. All hardware used to mount the

control cabinet, auxiliary cabinet and other components to the support structure shall be stainless steel.

There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a ten (10) inch by twelve (12) pocket for log sheet storage. The nameplate shall contain the following information: voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, operating point and head. KW input, and amps at the operating point and at least two other points on the pump curve.

The control panel enclosure shall be Underwriters Laboratories (UL) 50 type 3R listed.

48.2.1

Each enclosure shall have installed in the interior, one standard surface mount light bulb receptacle with a sixty (60) watt bulb, operated by a standard light switch. The light bulb shall be located so as to illuminate all of the interior electrical components at night.

48.2.2

A separate enclosure, meeting all of the requirements for the main enclosure, and measuring twenty-four (24) inches wide by twenty-four (24) inches tall by ten (10) inches deep shall be provided for future component installation. This auxiliary enclosure shall be mounted back-to-back with the main enclosure, and shall be connected to the main enclosure with a single two (2) inch weather tight conduit having a maximum of two (2) ninety (90) degree bends.

## 48. 3 POWER SUPPLY AND MAIN DISCONNECT

Power supply to the control panel shall be either 240 volt, 3 phase, 4 wire or 480 volt, 3 phase, 4 wire. Minimum service shall be 100 AMP. Single phase power shall not be accepted.

Nonfusible safety service main disconnects shall be installed at all stations. In all 240 volt systems, disconnects should be installed between the meter and the panel and on all 480 volt systems disconnect should be installed ahead of the meter. LED power available indicators shall be supplied on all legs. Each panel box will be identified with a permanently affixed legend plate showing the panel voltage and amperage.

## 48. 4 CIRCUIT BREAKERS

### 48. 4. 1 MAIN BREAKERS

The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one breaker is in the "on" position at a time. Both breakers shall be equal in size. (See approved

manufacturers' list in appendix.)

48. 4. 2 CIRCUIT BREAKERS

All circuit breakers shall be heavy duty molded case breakers. The handle on the circuit breakers shall be operational through the inner door. (See approved manufacturers' list in appendix.)

## 48. 5 MOTOR CIRCUIT PROTECTORS

Each pump motor shall be protected by a 3-pole motor circuit protector. (See approved manufacturers' list in appendix.) The Motor Circuit Protector shall be operated by a toggle-type handle and shall have a quick-make, quick-break overcenter switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the Motor Circuit Protection to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor Circuit Protector must be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual push-to-trip button shall be provided for manual exercising of the trip mechanism. Each pole of these Motor Circuit Protector's shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

## 48. 6 MOTOR STARTER AND SELECTOR SWITCHES

The panel shall contain two (2) motor starters. The motor starter shall be across the line magnetic starter with individual overload protection on each power leg with reset installed through the inner door unit. (See approved manufacturers' list in appendix.) Local Power Company Regulations shall govern.

Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy duty oil tight "Hand-Off-Auto" three (3) position switch to control the operation mode of each pump motor starter.

## 48. 7 PUMP ALTERNATOR

An eight (8) pin plug-in solid state alternator (see approved manufacturers' list in appendix) shall be provided to change the pump starting sequence on each pumping cycle. A three (3) position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "Auto" to provide normal automatic sequence, "Off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

## 48. 8 LIGHTS AND ALARMS

### 48. 8. 1 INDICATOR LIGHTS

There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights as shown on the STANDARD DRAWINGS.

### 48. 8. 2 HIGH LEVEL ALARM

A vapor proof red flashing light and horn shall be mounted on top of the panel for high level alarm. Also, there shall be an alarm silence pushbutton on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The pushbutton shall be heavy duty oil tight. The red globe shall be Lexan or similar vandal-proof plastic, and shall be the screw-on type.

### 48. 8. 3 ALARM DIALER

A telephone alarm dialer with four (4) alarm channels plus power outage alarm will be provided and installed in each lift station main electrical control panel by the panel box manufacturer. Telephone dialers shall not be field installed. The CONTRACTOR shall be responsible for the installation of the necessary telephone line(s) to the panel.

## 48. 9 ADDITIONAL REQUIREMENTS

### 48. 9. 1 WIRING

All power wires shall be THW or THWN 75 Degree C insulated stranded copper conductors and shall be appropriately sized for the given load application. All control circuit wire shall be type THW; Size 14, stranded type. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.), Color: Red, 24 volt; white, neutral; black, 120 volts. Each motor's power lead shall be run from the wet well to the control panel through a separate two (2) inch PVC electrical conduit. If the motor power lead consists of more than a single cable, the conduit size shall be increased to three (3) inches. Float leads for each pump shall be grouped together in a single two (2) inch PVC electrical conduit.

### 48. 9. 2 TERMINAL POINTS

Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.

## 48. 9. 3 ENGRAVED NAMEPLATES

All circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicoid-type engraved nameplates where applicable.

## 48. 9. 4 SURGE PROTECTOR

A surge protector shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be U.L. approved and installed per respective power company requirements and manufacturer's specifications. Surge protectors shall be attached to the main disconnects.

## 48. 9. 5 ELAPSED TIME METERS

Elapsed time meters shall be 115 volt not-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.

## 48. 9. 6 CONVENIENCE RECEPTACLE

On the face of the inner door unit, there shall be installed a 15 AMP 120 volt, duplex convenience receptacle. It shall be provided with it's own single pole, 15 AMP circuit breaker for protection. Ground fault interrupt type shall be required.

## 48. 9. 7 CONTROL TERMINAL BLOCKS

Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. An additional thirty (30) space terminal strip shall be installed in the cabinet for future use, with RTU equipment.

## 48. 9. 8 CONTROL POWER TRANSFORMERS

There shall be a control power transformer with a minimum size of 500VA to provide 120VAC power for: coils for starters, 15A duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters etc. The secondary side shall have one leg fused and the other grounded. This control power transformer is required only on 480 volt control panels.

The signal required by the float switches and relays shall be 24VAC. This shall be provided by a 24VAC control power transformer properly sized with a fused secondary.

## 48. 9. 9 CONTROL RELAY

The level control relays shall operate from 24VAC. They shall be enclosed,

plug-in 8 pin type with octal-style screw terminal sockets.

48. 9. 10 ELECTRICAL SCHEMATIC

There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to CITY personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

48. 9. 11 PHASE MONITOR

For all 240 volt stations an eight pin plug-in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight pin phase monitor with the eight pin alternator. All 480 volt stations shall have surface mount type phase monitors.

## 48. 10 TESTING, SERVICE AND WARRANTY

48. 10. 1 TESTING

After fabrication in the control panel manufacturer's plant, an operational test shall be performed to check out the entire panel before delivery. The intended three (3) phase source voltage shall be used for the testing.

48. 10. 3 WARRANTY

The manufacturer shall furnish a five (5) year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this section.