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APPENDIX A

SEWER PUMP STATION SPECIFICATION



## SECTION 1

### GENERAL

All work involved in constructing sewer pump stations shall conform to the applicable provisions of the California Department of Transportation Standard Specifications, current edition, hereinafter referred to as Standard Specifications, City Standards, the improvement plans and these specifications.

The following specifications represent the minimum specification allowable for a duplex sewer pump station. Additional features or specifications may be required as needed.

## SECTION 2

### REINFORCED CONCRETE

#### Scope of Work:

The work included herein shall conform to Section 51 "Concrete Structures" and Section 90 "Portland Cement Concrete" of the Standard Specifications. This work shall consist of furnishing all labor, tools, equipment and materials necessary for the installation of all structural concrete, minor concrete and mortar as shown on the plans and specified herein.

#### Structural Concrete:

##### Strength:

The minimum ultimate (28 days) compressive strength of all structural concrete shall be 3250 psi.

##### Concrete Mix:

All structural concrete shall be Class "A" (564 pounds of cement/cubic yards of concrete) with Type II Portland Cement. The maximum size of aggregate shall be 1- $\frac{1}{2}$  inches.

##### Slump:

The amount of water used for mixing (including free moisture carried by the aggregate) shall not exceed the maximum necessary to produce a 4 inch slump as determined by ASTM test method C-143.

##### Placing:

Concrete shall be placed in accordance with Section 51-1.09 "Placing Concrete" of the Standard Specifications.

##### Forms:

All formwork shall conform to Section 51-1.05 "Forms" of the Standard Specifications.

##### Defective Concrete:

Concrete not meeting the minimum strength requirement, not formed as indicated, not true to intended alignment, which has large voids or rock pockets, which has wood or other debris embedded which has a surface deviation greater than 1/8 inch in 10'-0", or does not fully conform to the specifications shall be deemed defective, and if so directed by the Engineer, shall be removed and replaced with concrete complying with the drawings and specifications.

Minor Concrete:

Concrete Mix:

All minor concrete shall be Class "A" (564 pounds of cement/cubic yards of concrete) with Type II Portland Cement. The maximum size of aggregate shall be 1 inch.

Formwork:

Earthen forms for exterior concrete surfaces shall be allowed only upon approval by the Engineer. The acceptability of the earthen forms shall be solely decided upon by the Engineer.

Mortar:

All mortar shall conform for Section 51-1.135 "Mortar" of the Standard Specifications.

Non-Shrink Grout and Drypack:

Non-shrink grout shall conform to Section 50-1.09, "Bonding and Grouting" of the Standard Specifications with a required admixture using the following proportions:

Portland Cement.....	1 Part by Wt.
Sand (100% Passing #8 Sieve)....	1 Part by Wt.
Water.....	4 1/2-5 1/2 gal./sack cement
Sika "Intraplast" N Admixture...	1% by Wt. of cement

Drypack shall be composed as for grout except that only enough water shall be added to wet the mixture (no free water and no slump). Drypack shall be tamped into place and cured as specified for concrete in this section.

Contractor shall not use non-shrink grout or drypack that has been mixed longer than 30 minutes. No retamping shall be allowed.

Finishes on Walking Surfaces:

The contractor shall give a monolithic finish to the walking surfaces at all concrete floors and slabs within and adjacent to the structures which are to be constructed under this contract. All concrete surfaces to be so finished shall be thoroughly worked, brought to a uniform smooth finish and given a final brush finish

Curing:

All newly placed concrete shall be kept moist for the first seven (7) days after the concrete has been placed. This shall be achieved by one of the following methods:

1. Ponding
2. Cotton mats, rugs or carpets kept continuously wet.

3. Kraft paper or plastic film with joints dealing or tapered. The perimeter of the paper shall be sprinkled once daily.
4. Curing compound method: All exposed cast in place concrete shall be cured with white pigmented curing compound (State Spec. 8030-71D-05, Type 1) in accordance with Section 90-7 "Curing Concrete", of the Standard Specifications.

Forms may be used to cure formed portions in accordance with Section 90-701D "Forms-In-Place Methods" of the Standard Specifications. If the forms are removed prior to seven (7) days after the pour, the newly exposed areas shall be cured for the remainder of the seven (7) days by one of the above methods.

## SECTION 2

### METAL WORK

#### Scope of Work:

The work included herein shall conform to Sections 52-"Reinforcement", 55 - "Steel Structures" and 75 - "Miscellaneous Metal" of the Standard Specifications. This work shall consist of furnishing all labor, tools, equipment and materials necessary for the installation of all reinforcing steel, structural steel and miscellaneous metal as shown on the plans and specified herein and as directed by the Engineer.

#### Reinforcing Steel:

##### Materials:

1. Bars shall be deformed bars conforming to ASTM A-615, as follows:

<u>Bar Size</u>	<u>Grade</u>
#4 and smaller	Grade 40
#5 and larger	Grade 60

2. All reinforcing steel shall be new, clean, free from oil, dirt, loose mill scale, excessive rust, mortar, or other coatings that would destroy or reduce the bond.

#### Placing Reinforcement:

The bending and placing of all reinforcement shall conform to the "Manual of Standard Practice" of the American Concrete Institute. Bends shall be made around a pin having a diameter of not less than four (4) times the bar diameter for stirrups and ties, six (6) times the bar diameter for other bars except for bars larger than 1" which shall be eight (8) times the bar diameter. Bars shall be bent cold.

Reinforcing shall be accurately placed in accordance with the drawings and shall be securely tied in position with at least No. 16 gauge annealed wire at all bar intersections. Metal chairs and bolsters shall be used to hold all steel above the form bottoms at the proper distance. Metal spacers shall be used to secure the proper spacing of the steel. Precast concrete blocks shall be used to support reinforcing steel off the ground in footings and off the soffit of concrete exposed to weather. The clear distance between parallel bars shall not be less than 1 1/2 times the bar diameter, but in no case less than 1 1/2 inches nor less than 1 1/3 times the maximum size of coarse aggregate.

Splices shall be made with a lap of at least 30 bar diameters unless noted otherwise. The bars shall be placed in contact and wired together in such a manner as to maintain a clearance of not less than the minimum clear distance to the other bars and to the surface of the concrete. Minimum clear distance to all concrete surfaces shall be 2 inches unless otherwise noted on the plans.

Pump Access Covers:

The wet well shall be equipped with a pump access cover for each pump as shown on the plans. Access covers shall be stainless steel-fitted aluminum construction, designed for access to submersible pumps. Covers shall be equipped with a guide bar bracket, safety chain hook, electric cable support, and a hasp for a padlock. Covers shall be of a size compatible with the pumps.

Valve Box Access Cover:

Cover shall be double leaf, channel frame aluminum construction with stainless steel hardware and a hasp for a padlock. Cover shall be of a size compatible with valve box opening, minimum size shall be 5' x 6' with each leaf being 3.0' x 5'. The cover shall withstand a liveload of at least 300 pounds per square foot and be equipped with spring door operators and automatic holdopen arms. The cover construction shall have a mill finish with Bituminous Coating applied to exterior of the frame.

Anchor Bolts and Concrete Anchors:

Concrete anchorage devices shall be installed in the concrete as shown on the plans so that the attached equipment will bear firmly against the concrete. The concrete anchors for the pump discharge mount shall be RED HEAD RED-CHEM STAINLESS STEEL CONCRETE ANCHORS # CHEM-2034, 3/4" Diameter, or approved equal.

Bolted Connections:

All bolts, nuts and washers within the wet well shall be stainless steel.

## SECTION 3

### PAINTING

#### Scope of Work:

Under this item, the Contractor shall furnish and apply to the satisfaction of the Engineer, protective paint in colors as selected by the Engineer. All exposed interior and exterior metal surfaces, except aluminum, galvanized steel, stainless steel and chrome plated metal, shall be coated.

All paint shall be delivered in original containers and shall be applied in strict accordance with the recommendations of the manufacturer.

#### Preparation of Surfaces:

##### Concrete Surfaces:

Before painting, all concrete surfaces to be painted shall be thoroughly cleaned. Surfaces to be painted shall be completely wire brushed to remove any loose concrete or paint, and cracks shall be patched. Concrete surfaces to be painted shall have all air pockets or other imperfections filled, so that a smooth surface results. All surfaces shall be completely dry prior to painting.

Concrete surfaces which shall be coated with a protective coating for the purpose of protecting the concrete surface, shall have all air pockets or other imperfections in the concrete filled, so that a smooth concrete surface results, after the surface has been opened, it shall be sacked to fill the voids with mortar. Sacking shall be accomplished soon after the removal of the forms to promote adequate adhesion. Covering over the surface with a thin layer of mortar shall not be acceptable.

##### Metal Surfaces:

All metal work to be painted shall be absolutely clean and free of all rust and grease.

All exposed cast iron or steel piping to be painted, which has a previously applied coal tar derivative, shall be primed, prior to finish coating, with two (2) coats of Koopers "Tarstop", or approved equal.

##### Completion of Surface Preparation:

After the Contractor has completed the job of preparing all surfaces to be painted, the surfaces shall be inspected and approved by the Engineer prior to the application of any protective coatings.

### Materials:

Under these specifications, all paint products to be furnished for application shall be as manufactured by Koppers, or approved equal.

### Coating System:

- A. One (1) coat of Bitumastic #50 M. The completed surfaces shall have a dry thickness of at least 16 mil.
- B. Two (2) coats of Bitumastic #300 M, First coat to be red, second coat to be black. Application of second coat to be applied within 24 hours of the first. The completed surfaces shall have a dry thickness of at least 16 mil.
- C. One (1) coat of 622 Rust Penetrating Primer followed by two (2) coats of Glamortex 501 Enamel, color: OSHA Safety Blue.

The completed surfaces shall have a dry thickness of at least 3 mil.

### Exterior Concrete Painting:

Coating System A shall be used to paint the wet well and valve box exterior surfaces in contact with the soil.

### Interior Concrete Painting:

After surface preparation, the Contractor shall paint all submerged concrete surfaces, surfaces exposed to sewage fumes, all valve box interior, with coating System B.

### Wet Well Metalwork Painting:

All exposed metalwork surfaces which are submerged or subjected to sewage fumes shall be painted with coating System B. Metal located within water containing compartments shall be considered submerged. The pumps, pump discharge, pump power cables and lifting cables are not to be coated. Also the access covers are not to be coated.

### Valve Box Metalwork Painting:

All exposed metalwork surfaces in the valve box shall be painted with coating System C. The access cover is not to be coated.

SECTION 4

PIPEWORK

Scope of Work:

Under this section, the Contractor shall furnish all labor and materials for, and shall install, complete and test as specified, all pipework and appurtenances constructed under this contract.

Shop drawings are required to be submitted by the Contractor to the Engineer for all fabricated pipework, valves and special fittings.

Materials:

PVC Gravity Sewer Pipe:

PVC sewer pipe shall conform to City of Bakersfield standards and the requirements of ASTM D 3034, SDR 35, and shall have gasketed joints.

PVC Force Main:

PVC force main shall conform to AWWA C900 and shall be class 150.

Ductile Iron Pipe (D.I.):

Ductile iron pipe and fittings shall be cement mortar lined. Pipe joints shall be flanged or as shown on the plans. Applicable sections of the following standards apply.

<u>Standard</u>	<u>Item</u>
AWWA C151	Ductile Iron Pipe
AWWA C104	Cement Mortar Lining
AWWA C110	Fittings
AWWA C111	Rubber Gasket Joints

Cast Iron Fittings (C.I.):

Cast iron fittings shall be in accordance with the American Water Works Association Standard C110-77, "Gray Iron and Ductile Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids".

### Couplings and Flanges:

In the locations shown on the plans, flanged coupling adaptors shall be Ford Style FFCA and flexible couplings shall be Ford Style FCI or approved equal.

Flanges shall be of a size and pattern to fit valves and other piping to which they are to be connected.

### Small Piping and Fittings:

These specifications shall apply to all metal pipe four inches (4") in diameter and smaller, other than cast iron piping, and shall also apply to all valves and cocks, unions, fittings, and connecting devices, and to pipe lines furnished as a part of the several piping and equipment items within the pump station. Small pipe shall include all nuts, bolts, gaskets, hangers, supports, the drilling of holes and flanges, and all materials and labor that may be necessary to the best installation of this class of work.

#### Fittings:

All screwed fittings shall be "American Standard Malleable Iron Screwed Fittings", 300 lb. W.O.G. of standard form and dimensions. Malleable iron shall conform to current standard specifications for malleable iron.

Castings, as adopted by the American Society for Testing Materials. All fittings shall be galvanized to correspond with pipe on which they are installed.

All fittings necessary for the satisfactory alignment and arrangement of piping and all necessary unions and cleanouts shall be furnished by the Contractor.

### Gate Valve:

All gate valves shall have standard flanged ends. Each valve shall have a 2" square operating nut. Valves shall correspond in size with the run of pipe on which it is installed, except as otherwise noted. Gate valves shall be 4" CLOW AWWA, F-5070, or approved equal.

### Swing Check Valve:

Check valves shall be flanged, iron body, bronze-mounted check valves. Hinge pins shall be stainless steel or other noncorrodible metal, and the stuffing box assembly shall be made of bronze, securely screwed to the valve body. Swing check valves shall be Mueller check valves catalog number A-2600-6.02 or approved equal.

### Pipework in Concrete:

Where formed holes are left in the concrete, the Contractor shall be responsible for the accuracy of their location and for sealing around pipes to produce watertightness where necessary. He shall also provide any necessary pipeline openings through the concrete which may have been omitted.

Domestic Water Service:

The Contractor shall provide and install all items as shown on the plans and as needed to supply 1" water service to the valve box. The Contractor shall also coordinate installation of the service meter with California Water Service Company or the utility company providing water service to the site.

Meter and Valve Box:

The meter and valve box shall be a Christy B-12 Box with #S20 cover or Brooks Products Number 37.

Reduced Pressure Backflow Preventer:

The backflow preventer shall be a reduced pressure principle type and shall be suitable for supply pressure up to 175 psi. The backflow preventer shall be designated for inline servicing. The device shall be Febco Model 825Y for a 1" service, or approved equal.

Domestic Water Spigots:

Contractor shall supply one (1) spigot as shown on the plans.

Wet Well Water Stops:

All cored openings in the wet well wall shall be sealed with water stops secured by stainless steel bands and non-shrink grout as specified in Section 2.

Water stops shall be Fernco "Large Diameter Water Stops", or approved equal.

Discharge Wash-Down Assembly:

Wash-down assemblies as shown on the plans shall use 8" x 1" Tap Rockwell 323 Double Strap bronze saddles, or approved equal.

Wet Well Construction:

Wet well shall be constructed using \_\_\_\_\_ diameter Class \_\_\_\_\_ reinforced concrete pipe sections manufactured to meet ASTM Standards C76, C443, and C655. The wet well shall be constructed with no more than three pipe sections. The lower wet well section shall be a minimum of 6 feet in length.

Interior surfaces shall be painted prior to the installation of pumps. The discharge connection mating surface shall be kept clean and free of all paint.

Sewer Manholes:

The Contractor shall construct the sewer manholes as shown on the plans per City of Bakersfield Standard S-7.

SECTION 6

MECHANICAL EQUIPMENT

Scope of Work:

Under this section the Contractor shall furnish and install all mechanical equipment and appurtenances for this project as shown on the plans and hereinafter specified. All such equipment shall be placed by the Contractor in satisfactory operating condition as an integral part of the construction of the project.

The Contractor shall provide and install all necessary items and appurtenances required for the proper placement and functioning of the project components as intended, whether such items and appurtenances are directly specified or not.

All equipment shall be designed, manufactured and assembled in such a manner so as to perform satisfactorily within housings, enclosures and the environment into which it is to be installed and operated. All items shall be tested in place. Required supervision for installing, testing and starting shall be furnished by factory-trained personnel at no charge.

The Contractor shall verify all actual dimensions of existing and new construction equipment areas, bases and mountings; and he shall be responsible for insuring proper fit of the equipment selected for installation. The Contractor shall be fully responsible for the compatibility of furnished mechanical, electrical, pipework and structural items and appurtenances.

Pump Warranty:

The pump manufacturer shall warrant the pumps and motors being supplied to the owner against defects in workmanship and materials for a period of one (1) year under normal use, operation and service. The warranty shall be in printed form and shall apply to all similar units.

Submersible Pumps, Motor and Slide-away Coupling

The Contractor shall furnish and install a totally submersible pump, as shown on the plans and as described hereinafter. The pumping unit shall conform to the following characteristics:

Two (brand) size (size) Model \_\_\_\_\_ Torque-flow vortex submersible pumps with \_\_\_\_\_ HP, \_\_\_\_\_ phase, \_\_\_\_\_ volt, \_\_\_\_\_ hertz submersible motors and slide-away casings.

Pump casing shall be constructed of ASTM A48 Class 30 grey iron and shall be completely open from suction to discharge with no wearing rings or impeller faceplates required. All internal case clearances shall be equal to the discharge diameter so that all material which will pass through the discharge can pass through the pump.

The impeller shall be of the recessed design, constructed of ASTM A48 Class 30 grey iron and shall be mounted completely out of the flow path between the pump inlet and discharge connection, so that the solids pumped are not required to flow through the impeller. The impeller shall be keyed to the motor shaft and secured by an impeller bolt.

The motor shall be provided with thrust and radial bearings to carry the entire load which may be imposed upon it under all operating conditions. Motor shall be approved by Underwriters Laboratory for operation in a Class I, Group D, Division I hazardous location.

The motor shall have two mechanical seals - the lower one outside the motor and protecting the upper one which is an oil-filled chamber. Moisture detector probes in the oil-filled seal chamber shall be connected to a customer-supplied alarm to indicate the presence of moisture in the seal chamber. Thermal overload protectors shall be imbedded in the motor windings and connected to the starter to disconnect the motor in the event of overload.

The slide-away coupling shall consist of a foot-mounted discharge elbow and adaptor, steel baseplate, upper and lower rail supports, lifting yoke and cable. All metal to metal interfaces where movement might occur shall be non-sparking. The foot-mounted discharge elbow and adaptor shall conform to ASTM A48 Class 30 grey iron.

Lifting cable and hardware shall be stainless steel. Cable shall have a minimum working load of 2,400 lbs. and shall be supplied by the pump manufacturer.

#### PERFORMANCE

Each pump shall be capable of operating at the following conditions:

First design point = \_\_\_\_\_ GPM @ \_\_\_\_\_ ' TDH.

Second design point = \_\_\_\_\_ GPM @ \_\_\_\_\_ ' TDH.

(Minimum)(Maximum) shut off = \_\_\_\_\_ feet.

Impeller selected shall be capable of operating at all three design points without exceeding \_\_\_\_\_ BHP.

Minimum clearance through case = \_\_\_\_\_ "

### Pump Test:

The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory.

1. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.
2. A motor and cable insulation test for moisture content or insulation defects.
3. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
4. The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water.
5. After operational test No. 4, the insulation test (No. 2) is to be performed again.

A written report stating the foregoing have been done shall be supplied with each pump at the time of shipment.

The pump cable end will then be fitted with a shrink fit rubber boot to protect it prior to electrical installation.

### Documentation:

Standard drawings supplied shall include pump outlines, controls, access frames and typical installation guides. Electrical control wiring diagrams shall be supplied. Instruction and maintenance manuals and pump parts lists for the pumps installed shall also be supplied.

### Acceptance Tests:

After installation, each pumping unit shall be given a running test, during which it shall demonstrate its ability to operate without vibration, overheating or excessive current draw, and to pump the capacity and head specified. These tests are to be conducted by the Contractor in the presence of the Engineer. The Engineer shall be given at least 24 hours notice in advance of each test.

During the tests, observations shall be made of motor input, vibration, noise and overheating to detect any defects in the equipment. Written results of each test shall be submitted by the Contractor to the Engineer prior to approval of the tested pumps.

The Contractor shall provide at his expense the necessary water, gauges, meters, piping and labor necessary for conducting the tests. All adjustments needed to place the equipment in satisfactory working order shall be made at the time of the tests. All defects or defective equipment revealed by or noted during a test shall be corrected or replaced promptly at the expense of the Contractor, and if necessary, tests shall be repeated until satisfactory results are obtained.

In case the Contractor is unable to demonstrate to the satisfaction of the Engineer that the units will satisfactorily perform the service required, and that they will operate free from vibration and over heating, the units may be rejected. The Contractor shall then remove and replace the equipment at his own expense.

## SECTION 7

### ELECTRICAL WORK

#### Scope of Work:

The Contractor shall provide all the required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, test equipment, and satisfactorily complete all the electrical work shown on the drawings and included in these specifications.

The electrical work for this project includes the providing of all electrical materials and equipment required for a complete and fully operating facility. The Contractor shall provide temporary power for system testing.

Included in this work is the providing of all required conduits, conductors, and cables including those specified; shown on the drawing; and neither specified nor shown on the drawings but nonetheless required for satisfactory interconnection and operations of all electrical, mechanical and instrumentation equipment either shown on the respective drawings, specified in the respective portions of the specifications, or otherwise required.

#### Codes:

All the electrical equipment and materials, including their installations, shall conform to the following applicable codes:

1. National Electrical Code, Latest Edition
2. State Electrical Code, Latest Edition, Title 24 Part 3
3. Occupational Safety and Health Act Standards
4. City of Bakersfield Codes and Ordinances

#### Variances:

In instances where two codes are at variance, the more restrictive requirements shall apply.

#### Standards:

Equipment shall conform to the applicable EIA, IEEE, and NEMA Standards.

#### Drawings:

The electrical drawings shall govern the general layout of the completed construction. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or materials, the requirements or descriptions in this specifications shall take precedence in the event of conflict.

1. Locations of equipment, inserts, anchors, motors panels, conduits, stub-ups, fittings, power and convenience outlets and ground wells are approximate unless dimensioned, and the Contractor shall be responsible for field verifications of scaled dimensions on drawings.
2. The Contractor shall review the drawings and specifications of other trades and shall perform the electrical work that will be required for the installations.
3. Should there be a need to deviate from the electrical drawings and specifications, the Contractors shall submit written details and reasons for all changes to the Engineer for approval.

Securing Equipment:

The Contractor shall provide the required inserts, bolts and anchors, and shall securely attach all equipment and materials to their supports.

Cutting, Drilling and Welding:

The Contractor shall provide the required cutting, drilling and welding that is necessary for the electrical construction work. Cutting and drilling structural members shall not be permitted, except when approved by the Engineer. A core drill shall be used wherever it is necessary to drill through concrete. The Contractor shall provide the required welding for equipment supports. Patchwork shall be completed with the same materials and finished to match the surrounding area.

Conduit:

All electrical conduit shall be PVC Schedule 80 unless otherwise specified.

Ground Rods:

Ground rods shall be Copperweld, not less than 1/2" X 8'.

Control Panel:

Contractor shall furnish and install one duplex air bubbler control panel (conforming to NEMA 3R and 12 standard) with a hinged inner door (dead front) fabricated from 5052-H32 0.080 thick marine alloy aluminum. The inner door shall be held closed by two hand operated, 1/4-turn fasteners and shall contain the control instruments and indicators. The tamperproof outer door shall be lockable using a hasp. Ventilation shall be provided by louvers on one side of the enclosure.

Enclosure shall be a double compartment           (size)           and contain space for service entrance equipment on the left side.

## Control Panel (Continued):

The entire control panel shall be UNDERWRITERS LABORATORY LISTED and furnished with a UL LABEL. Each component shall be factory mounted, wired, inspected and tested. A wiring diagram and heater chart shall be enclosed in the panel. A red "High Voltage Inside" nameplate shall be fastened to door covering the high voltage compartment. All components including indicating lights, switches, buttons, relays, accessories, and permanently identified as to their function with the components. The identifications shall be in the form of photo etching, silk screening or engraving. All terminal blocks shall be identified by both number and graphic symbols which clearly indicate the purpose of each terminal block. All control wiring shall be numbered at each termination. The panel enclosure shall be free standing and mounted on a reinforced concrete pad. The lower compartment shall have a lockable access door and be flush with the concrete pad.

The enclosure shall be constructed of 14 gauge steel. The entire unit shall be degreased, cleaned and treated with a phosphatizing process, then primed and painted inside and out with corrosion-resistant, industrial-grade baked enamel. The finish coat shall be ASA-61 Gray.

## Control System Operation

The control system shall provide total automatic control for two (2) motor driven pumps operating on \_\_\_\_\_ volts, \_\_\_\_\_ phase, \_\_\_\_\_ wire service. The wet well level shall be monitored and controlled as follows:

- Level 5 - High Level
- Level 4 - Start Lag Pump
- Level 3 - Start Lead Pump
- Level 2 - Stop Lag Pump
- Level 1 - Stop Lead Pump

Contingent upon the wet well level, the bubbler system shall cause the liquid level indicator/controller to energize the appropriate control contacts. Upon wet well level rise, the lead pump start contact (Level 3) shall be energized causing a relay in the pump logic controller to start the lead pump. If the level continues to rise to the lag pump start control (Level 4), the controller shall energize a relay to start the lag pump, and both pumps shall run simultaneously. The liquid level shall be lowered until the lag pump stop contact (Level 2) is reached, stopping the lag pump. The lead pump shall continue to run lowering the wet well level until the lead pump stop contact (Level 1) is reached. Upon the next wet well level rise, the lead pump selection shall be alternated. If the wet well level rises to high level contact (Level 5), it shall energize a relay in the pump logic controller to operate the alarm system and indicate a high water condition.

The control system shall be built in such a manner that the owner will have the ability to select high level alarm activation at a separate specific level or have it activated when start lag pump level is reached. The owner shall have the ability to select independent start and stop for the lead and lag pumps, or a common stop for both pumps.

CONTROL PANEL (CONTINUED):

Liquid Level Indicator/Controller

The wet well level shall be monitored and maintained by a well-type manometer with mercury media that makes and breaks a series of electrical contacts as the mercury rises and falls in direct proportion to the change of the liquid level in the wet well. Digital read out or horizontal needle deflection instruments are not acceptable. The manometer shall have one common 24 VAC electrical contact and a vertical row of contact points, which when coming in contact with the column of mercury shall signal a relay in the pump logic control to perform the pump operation and alarm functions. The liquid level indicator/controller shall have a viewing window which shall display the mercury column, and be calibrated in both feet and inches of water indicating the liquid level in the wet well. The unit shall be mounted on the dead front door.

The unit shall be an electro-mechanical device with no moving parts. The unit shall be factory calibrated and not require field calibration. Accuracy shall be plus minus  $\frac{1}{2}$  percent of full scale with 100 percent repeat accuracy and zero dead band when making and breaking electrical contacts. Indicated full scale range shall be zero to ten feet with front scale graduated in feet (0 to 10 feet) and inches (0 to 120 inches) the vertical, linear, mercury column shall have a total of 40 control points providing an electrical output for every three inches of water pressure, and shall be individually labeled as to the level at which they are activated. The liquid level indicator/controller shall be manufactured from corrosion resistant material.

The liquid level indicator/controller shall be equipped with manual testing capability located on the inner door. The testing system shall consist of a two position normal test/blowdown manually operated toggle valve and test-port. Test position shall seal off and prevent liquid from rising in the submerged bubbler tube. Simultaneously, it shall divert the bubbler air output to the test port and relieve any air pressure on the indicator/controller. The operator shall be able to simulate rising and falling liquid level by restricting the air flow exiting the test port.

The control panel shall be equipped with a  $\frac{1}{4}$ " NPT female bulkhead fitting located on the inner door for the purpose of applying high pressure air to purge any obstruction in the bubbler tube should it become clogged. Protection shall be provided to prevent high pressure air for blowdown from damaging the liquid level indicator/controller. Blowdown must be possible without having to disconnect any tubing or fittings.

All fittings shall be brass or stainless steel and assembled with LOC-TITE adhesive. All tubing fittings shall be barbed with a minimum of three barbs. Tubing shall be clear urethane. The control system shall be equipped with an external  $\frac{1}{4}$ " NPT female bulkhead fitting for connection to the bubbler tube in the wet well.

The air bubbler tubing from the panel to the wet well shall be size 3/8 polyethylene. The tubing shall be fastened to the wet well wall using stainless steel rubber backed brackets and stainless steel fasteners. The tubing shall terminate into an air cell constructed of size 1" PVC pipe with brass adapter.

The standard air supply for the bubbler system shall be two continuous running, oil-less, diaphragm-type air pumps. The air pumps shall each deliver .6 SCFH @ 5.5 PSIG. A fixed orifice shall be installed in line with the air pumps output

## Control Panel (Continued):

to insure a ripple free air flow. The air pump designated as "lead" shall provide the air flow to operate the bubbler systems. The designated "lag" air pump shall be automatically energized if the "lead" air pump fails. Indication of failure shall be monitored by measuring the AIR FLOW RATE of the lead air pump.

The air flow controlled automatic transfer/alarm chassis shall consist of an automatic electro-mechanical circuit which transfers to the lag air pump whenever air flow from the lead air pump drops to less than 0.15 SCFH for a period of 15 seconds. If the lag air pump fails to produce flow for a period of 120 seconds, an isolated contact shall close relaying a signal which will activate the high water alarm. A push button shall be provided to manually reset the circuit to the "lead" air pump. Components to make-up this circuit shall include a flow meter, four LED status indicators and a reset push button; plus a push button flow switch with hermetically sealed contacts, a duplex receptacle for the air pumps, transfer relay, transfer timer and alarm timer all mounted on a single chassis.

## Logic Controls

The duplex logic control system shall consist of the logic chassis mounted on the subpanel and the logic panel mounted on the dead front door. The logic chassis shall be a pre-wired assembly constructed of anodized aluminum containing logic and alarm circuits. The logic chassis shall interface with the wet well level liquid indicator/controller. The logic chassis shall contain a three point terminal block for 120 VAC supply power, a power on-off switch for 120 vac power, a 15 amp circuit breaker to protect 120 VAC power; a 120/24 VAC control transformer, a 3 position lead pump selector switch that can operate in either "automatic alternation"; "lead pump #1 - Lag pump #2"; or "lead pump #2 - lag pump #1" positions. Relays shall be square base, plug-in type, 3 pole double throw rated at 10 amp, 240 VAC with epoxy encapsulated coil and clear dust cover and shall be directly interchangeable. Five LED status indicator lights shall be mounted adjacent to the relay sockets and wired in parallel with the relay coils to indicate that the power is applied to the coils. All relays shall have mechanical hold-down bases.

All terminals on the logic chassis shall be of the barrier clamp plate type rated at 15 amp at 300 VAC and accept two (2) AWG#14 wires. Terminal blocks shall be provided for interfacing output from the liquid level indicator/controller to the logic chassis via a multi-conductor cable shall be identified with yellow heat shrink tubing with black nomenclature. Labels shall read as follows: High level alarm, start lag pump, start lead pump, stop lag pump, stop lead pump, and common.

The logic panel shall be constructed of corrosion resistant anodized aluminum, and connected to the logic chassis via a multi-conductor cable. The logic panel shall be mounted on the inner door. The logic panel shall have the following components: Two "hand-off automatic" selector switches for pumps, two "pump run" green LED Indicators, one 24 VAC "power on" yellow LED indicator, one "start lag pump" yellow LED indicator, one red pushbutton for audible alarm silence, one "high level alarm" red LED indicator and one red pushbutton for visible alarm reset. Provide two 6-digit non-resettable, dust tight, oil tight and moisture resistant running time meters.

## Control Panel (Con't)

### Power Handling

Main lugs of the appropriate size shall be furnished for connecting the incoming supply power. The lugs shall be suitable for use with aluminum or copper conductors. Ground lugs of appropriate size shall be bolted to the subpanel. Motor circuit protection shall be either thermal magnetic circuit breakers or magnetic motor circuit protectors. Either type shall contain a self test "Trip Selector" permitting a mechanical simulation of the over current tripping device. The protector operating mechanisms shall be quick-mate, quick-break and trip-free type. Thermal magnetic breakers shall comply with Federal SPE.W-C 357a as Class Two breakers. Symmetrical amperes interrupting ratings shall be 10,000 amps minimum for 250 volt rated breakers and 15,000 amps minimum for 480 volt rated breakers. Magnetic motor circuit protectors shall provide instantaneous clearing of faults to a minimum of 10,000 amperes, RMS, symmetrical and shall have an adjustable instantaneous trip setting. Q-Frame type circuit breakers are not acceptable.

Circuit breaker toggles shall be operable through external extension handles that will interlock with the dead front door.

Each motor starter shall be NEMA rated, FVNR, with three overload relays and reset button. The contractor shall feature double break, silver cadmium oxide contacts, pressure type terminals, and barriers, free floating armature-magnet frame, molded continuous duty coils and stainless steel springs sized for the specific pumps supplied under this contract. Definite purpose contactors, horsepower rated motor starters, and fractional NEMA sizes are not acceptable. Motor starter overload reset operators shall be installed on the dead front door allowing motor starter overload relays to be reset without opening the dead front door.

A 100 watt strip heater and separate thermostat set at the appropriate temperature to prevent corrosion-causing condensation and freezing shall be supplied.

A control transformer, adequately sized for the connected load shall be provided on 3 phase, 3 wire systems. The transformer shall be protected by fuses or circuit breaker. The control transformer may be eliminated on 4-wire and single phase systems providing that the control voltage is protected by a circuit breaker and is wired per N.E.C. standards.

The unit shall be equipped with the capability to connect a portable generator which will be activated by 60A, 600V, 3 phase transfer switch.

### Optional Equipment: (As required)

1. Provide a NEMA 4X, red lexan, break resistant globe and 75 watt lamp which shall be mounted on top of the enclosure. The globe shall be mounted with stainless steel screws and closed cell neoprene gasket to insure water tight integrity.
2. Provide a flasher which shall be installed and connected to the logic chassis to provide a flashing alarm light.
3. Provide dim glow terminals on the logic chassis so that the alarm light glows dim during normal condition to verify circuit integrity. When alarm condition occurs, the alarm light shall be switched to full brilliance.

Control Panel (Continued):

4. Provide a NEMA 4X encapsulated high intensity electronic horn mounted on the side of the enclosure. Audible rating of the horn shall be a minimum of 85 decibels at 10 feet.
5. A power monitor relay system shall be installed and connected to the logic chassis. When the power monitor relay is activated, it shall disconnect control power from the motor starters and illuminate red LED indicator on the logic chassis. The control power shall automatically reset if the fault conditions corrects itself. The power monitor relay shall be activated in the event that any of the following conditions occur:
  - a. Phase loss (single phasing) when any one of the three line voltages drop to 83 percent or less of nominal.
  - b. Phase reversal (sequence) when improper phase sequence is applied to equipment.
  - c. Low voltage (brown out) when all three line voltages drop to 90 percent or less of nominal.
6. Moisture sensing relays for each motor shall be installed and connected to the logic chassis. In the event that moisture enters the motor housing, the relay shall illuminate the red LED indicator on the logic chassis. Provide a back up control consisting of two mercury tilt switches with intrinsically safe relay circuits. The tilt switches shall be U.L. approved. The upper tilt switch shall engage both pumps and activate the high water alarm circuit. The lower switch shall disengage both pumps and de-activate the alarm circuit.
7. Provide a 750 watt duplex convenience receptacle with ground fault interrupter installed on the dead front door.
8. Wiring from the thermal sensor located in the pump motor shall be connected to the pump monitor provision on the logic chassis. In the event the sensor is activated, it shall disconnect control power from the appropriate pump motor starter and illuminate the red LED Indicator on the logic chassis. The circuit shall automatically reset on reclosure of the temperature sensor.
9. Provide an automatic two channel telephone dialer. The Dialer shall upon alarm condition call up to five predetermined numbers and deliver a voice message.

The message shall identify the location of the alarm, and the required action to be taken, and instructions for acknowledging the Dialer. The Dialer must be capable of calling at least five different telephone numbers for each channel. If the called telephone number is busy, or does not answer, or answers but is not acknowledged the Telephone Dialer proceeds to call the same number and/or proceeds to call different "backup" numbers. Each called party has the option to cancel all remaining calls or to allow the Dialer to continue the dialing sequence. The Dialer shall retain the programmed telephone numbers should there be a loss of power.

## Control Panel (Continued):

The called party shall be able to communicate with the Telephone Dialer by means of a tone signal. The signal is generated through a touch tone telephone set.

To prevent nuisance alarms the Phone Dialer shall have a time delay adjustment which will delay the starting of the calling cycle from 10 to 90 seconds. If during this delay time, or at any time that the Dialer is placing calls, the activating contact is restored to normal, the Telephone Dialer automatically hangs up and resets itself to the beginning number of the dialing sequence. The tripping circuits shall be desensitized with filters so that the time response shall be the same as a telephone type relay (approximately ten milliseconds). Input pulses of less than ten milliseconds shall be filtered out to eliminate false tripping due to lightning or voltage surges.

When any channel is tripped the Dialer shall continue the calling cycle until acknowledged, or the alarm condition is corrected. Independent memory circuits shall be provided for each channel. The system shall have an indicator light defining which channel is tripped. When the condition corrects itself, or it is reset, this light shall automatically reset.

The Telephone Dialer shall utilize a regular private line telephone circuit provided by the owner. Connection into the telephone circuit shall be through an industry standard 8 pin modular jack. The Phone Dialer shall have the proper cable for connecting into the telephone system modular terminal #RJ-31-X. The Phone Dialer shall provide all the necessary power and control switching for the built-in coupler with no auxiliary equipment, coupler, or power source required. All dial pulses and voice message inputs to the telephone system shall meet the requirements as published by the telephone companies, and shall be FCC approved for use on the telephone network.

A low voltage recharging circuit shall be provided to maintain the lead acid batteries in peak condition. An externally mounted pilot light shall indicate when the charging circuit is operational. The stand-by capacity of the Dialer shall be sufficient to sustain 1 (one) hour of continuous calling or up to 8 (eight) hours with the system in standby after complete power failure.

The Dialer shall have a built-in AC line monitor. This will allow the Dialer to monitor AC power or another function if desired. The Dialer shall have the option of being called from any of the programmed telephone numbers and being remotely tested. This test shall confirm proper operations of the Dialer and the telephone network. An off/on/abort switch must be accessible to facility testing and installation.

The Dialer shall be provided with a 1 (one) year warranty after acceptance by the Engineer, or a minimum of up to 2 (two) years after shipment date. The representative shall supply installation and operation data to the City and Engineer, and shall furnish factory authorized start up service and training at no additional cost to the City.

Control Panel (Continued):

10. Provide a spray system for breaking up the wet well floating scum blanket. Pump system shall recirculate a portion of the pumpage in the form of a spray.

Submittals:

Shop Drawings:

Shop drawings shall be submitted for approval prior to start of construction and shall include the following: a wiring diagram and an elementary control diagram for each unit; an overall connection diagram for each control panel; a dimensioned outline drawing to scale showing space for conduits, etc., complete identification of all electrical components in each control panel and their interconnections within the control panel; all connections to external equipment and controls; and wire marking scheme.

Spare Parts List:

A spare parts list shall be included showing recommended parts and quantities, as well as complete ordering information for replacement components. Instruction books shall be provided for special control devices and special equipment installed in the control panels. These shall be submitted to the Engineer prior to installation of the equipment.

Manuals

The Contractor shall obtain manuals from the manufacturer of the installed control panels and shall submit same to the Engineer as specified under "Submittals" of this specification section.

The complete system shall be the product of one manufacturer who shall have maintenance personnel that are factory trained to service and repair all components supplied. The guarantee period shall be for 2 years from the date of successful start-up. Guarantee shall include on-the-job repair and maintenance that cannot be performed by plant personnel.

