

SECTION 32 82 20

POND AERATION

PART 1 - GENERAL

1.1 SCOPE

- A. Contractor is to provide a complete and working aeration system. Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with the design and installation of the aeration system, and as specified herein. The irrigation pond contains a combination of groundwater and reuse water. The pond footprint is approximately 74,000 square feet and holds approximately 4,000,000 gallons of water. Items of work specifically included are:
1. Design of the aeration system to include shop and construction drawings.
 2. Procurement of all applicable licenses, permits, and fees as required by local codes and utilities.
 3. Coordination of Utility Locates ("Sunshine One Call").
 4. Connection of electrical power supply to the aeration system.
 5. Installation of compressors, electrical controls, piping, valves, aeration feeder/distribution tubing, aeration modules, and appurtenances necessary for the complete operation of the aeration system.
 6. Coordinating installation of aeration mechanical system with the installation of the new irrigation pond liner.
 7. Start-up, testing, adjustment of aeration system, and training of maintenance staff.
 8. Maintenance period.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
1. B16.5: Pipe Flanges and Flanged Fittings
- C. American Society for Testing and Materials (ASTM):

1. A48: Standard Specification for Gray Iron Castings
 2. A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 3. A105: Standard Specification for Carbon Steel Forging for Pipe Applications
 4. A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 5. A234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
- C. International Organization for Standardization (ISO):
1. 9001: Requirements for a Quality Management System
- D. National Electrical Manufacturers Association (NEMA):
1. NEMA 4: Indoor or Outdoor Enclosures with Protection Against Wind Blown Dust and Rain, Splashing Water, Hose Directed Water, and Undamaged by the Formation of Ice on the Enclosure.
 2. MG-1-12: Motors and Generators
- E. Underwriters Laboratories Inc. (UL):
1. File #E142155: Industrial Control Panels
- F. National Electric Code: (latest edition)
- G. Uniform Plumbing Code: (latest edition)

1.3 BIDDER QUALIFICATIONS

- A. Contractor must have demonstrated, using persons directly employed by the Contractor or subcontractor, experience with the installation of at least five (5) aeration systems having similar or larger capacity.
- B. Irrigation Contractor must be licensed in the State of Florida.

1.4 DISCREPANCIES:

- A. It is the intent of this specification that the all equipment shall be installed in the irrigation pump building and be complete and workable. It is the Contractor's responsibility to make sure that the equipment furnished is compatible and adheres to all regulations. Any discrepancies should be noted immediately and should be reported to the Contracting Officer for clarification

1.5 SUBMITTALS

- A. Provide four (4) copies of aeration system information in a 3-ring binder with table of contents and index sheet. Provide sections that are indexed and labeled for all equipment described within these specifications and required for a complete and usable system. Highlight items being supplied on the catalog cut sheets. Submittal package must be complete prior to being reviewed. Incomplete submittals will be returned without review.
- B. Materials List: Include pipe, valve, fittings, compressor, aeration feeder/distribution tubing, aeration modules, control system components, prefabricated weather resistant cabinet and electrical equipment. Quantities of materials need not be included.
- C. Manufacturers' Data: Submit manufacturers' catalog cuts, performance curves, specifications, and operating instructions for equipment shown on the materials list. Submit complete instructions for installation, operation, and recommended maintenance of the aeration system.
- D. Shop Drawings:
 - 1. Submit shop drawings of proposed aeration system. Show products required for proper installation, their relative locations, and critical dimensions. Submit technical data sheets, electrical schematics, sequence of operation, UL listing authorization form.
 - 2. Aeration system manufacturer is responsible for layout and design of the aeration system supplied, and any special coordination issues that affect the critical dimensions, layout, or orientation of the aeration system.
- E. Testing: Submit a proof of testing report including name of test, date of test, name of the individual completing the test, name of the company completing the test and a summary of the test results. Document all tests were passed.
- F. Testing report must be verified by the Contracting Officer prior to aeration equipment shipment.
- G. Maintenance and Operation Instructions: Submit information listed in Part 3 of these specifications.
- H. Record Drawings: Submit information listed in Part 3 of these specifications.

1.6 RULES AND REGULATIONS

- A. Work and materials must be in accordance with the latest edition of the National Electric Code and applicable laws and the latest edition of all applicable laws and regulations of the governing authorities.

- B. When the specifications call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the specifications.
- C. All electrical control panels with controls must be built in accordance to N.E.C., U.L. and E.T.L. standards. The electrical components and enclosure must be labeled as a complete U.L. listed assembly with manufacturer's U.L. label applied to the door. All equipment and wiring must be mounted within the enclosure and labeled for proper identification.

1.7 TESTING

- A. Notify the Contracting Officer five working days in advance of testing.
- B. On completion of assembly, hydrostatically test aeration system piping at a pressure not less than 50 PSI.
- C. Test, verify and demonstrate to the Contracting Officer the proper operation of all control and safety shut off devices.
- D. Test, verify and demonstrate to the Contracting Officer that system performance meets the specified flow and discharge pressure values.
- E. Acceptance Test Prior to Final Inspection:
 - 1. Upon completion of construction and prior to Final Inspection, an Acceptance Test must be passed.
 - 2. Coordinate start of Acceptance Test with Contracting Officer.
 - 3. During the Acceptance Test, the aeration system must be fully operational. The aeration system must operate with no faults for 14 consecutive days. If at any time during the 14 day test period, a system fault occurs, the source of the fault must be determined and corrected and the 14 day evaluation period will start again for an additional 14 days. If a system fault occurs, make repairs within 72 hours of notification. Document any faults in the proof of test report listing date of fault, fault, cause of the fault and the corrective action taken.
 - 4. When the system has operated for 14 days without fault, contact the Contracting Officer to schedule Final Inspection.

1.8 REVIEWS

- A. The purpose of on-site reviews is to observe the Contractor's interpretation of the documents and to address questions with regards to the aeration system installation.
 - 1. Scheduled reviews such as those for testing should be scheduled with the Contracting Officer as required by these specifications.

2. Impromptu reviews may occur at any time during the project.
3. A Final Inspection will occur at the completion of the aeration Acceptance Test. The intent of the Final Inspection is to verify that all installation; testing; maintenance and operation submittals; and project record drawing submittals are completed prior to the start of the Maintenance and Guarantee/Warranty periods.
4. All costs, including travel expenses and site visits by the Veterans Administration or Veterans Administration representative(s) for additional Inspection(s) that may be required after the Final Inspection due to non-compliance with the Construction Documents are the sole responsibility of the Contractor.

1.9 GUARANTEE/WARRANTY AND REPLACEMENT

- A. The purpose of this guarantee/warranty is to insure that the Government receives aeration system materials of prime quality, installed and maintained in a thorough and careful manner.
- B. The manufacturer shall warrant the aeration system to be free of defects and product malfunctions for a period of one year from date of Final Inspection.
- C. Failures caused by lightning strikes, power surges, vandalism, flooding, or operator abuse are excluded from warranty coverage.
- D. Repair damage to the premises caused by a defective item. Make repairs within 72 hours of notification.
- E. Replace damaged items with identical materials and methods or applicable codes. Make replacements at no additional cost to the contract price.
- F. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

1.10 GENERAL CONSTRUCTION REQUIREMENTS

- A. Coordinate installation of aeration system with the irrigation pond liner replacement.
- B. Control of Excavations: See Section 3.2 for safety and access directions.

PART 2 -MATERIALS

2.1 QUALITY

- A. Materials used in the system must be new and without flaws or defects of any type, and must be the best of their class and kind.

2.2 SUBSTITUTIONS

- A. Make complete submittals of all manufacturers' data showing compliance with the specifications.
- B. In making a request for a substitution to the Contracting Officer, the Contractor represents that he:
 - 1. Has investigated the proposed substitution and found that it is the same or better quality, level, capacity, function, or appearance than the specified product, and can demonstrate that to the Contracting Officer.
 - 2. Will coordinate the installation and make all modifications to the work that may be required for complete installation and operation of the system.
- C. The Contracting Officer will determine acceptability of the proposed substitution and will notify Contractor of acceptance or rejection.
- D. Pipe sizes referenced in the specifications are minimum sizes, and may be increased at the option of the Contractor upon approval by the Contracting Officer.

2.3 GENERAL REQUIREMENTS

- A. The aeration system and related equipment must be designed to function in the irrigation pump station building. The building will be ventilated to the outdoor environment. The building will not be air conditioned. Furnish protective enclosures and/or covers as required for proper operation of the system.
- B. The aeration system must have a capacity to aerate approximately 74,000 square feet and 4,000,000 gallons of water. The intent is to aerate the raw water irrigation pond.
- C. The aeration system includes dry running compressor, air cooled air aftercoolers, flow meters, gauges, fittings, valves, condensate traps, and piping as required.
- D. Completely assemble and operate all components of the aeration system prior to shipment to insure proper fit, assembly and operation on the job site.
- E. Connection of the aeration system to 120 volt, 60 hertz power supply.
- F. All system components must be supplied and be the responsibility of one manufacturer, even though some components were manufactured by others.
- G. The aeration system and related equipment must meet all the general and technical specifications; be designed, fabricated and installed in a workmanlike manner.
- H. Furnish shop drawing for approval prior to installation. Show pressure gauges, flow meter, filters, valves, etc. on shop drawings.
- I. Provide a factory-trained technician to supervise the installation of the aeration system.

J. Acceptable Manufacturers:

1. Keeton Industries (800) 493-4831, FAX (970) 568-7795 Model KR-4DP-B or approved equal.

2.4 COMPRESSOR SYSTEM

A. Furnish dry running articulated piston compressor as main aeration compressor.

1. Provide compressor with a minimum of 4.45 CFM flow rate at 40 PSI maximum discharge pressure.
2. Provide all electrical controls. Motor electrical requirement is 120 VAC/60 hz/1phase.
3. Equip compressor with air inlet filter and silencer.
4. The control system shall include NEMA motor starter with overload protection, 120V transformer, HOA switch, pressure switch, pressure gauge and runtime hourmeter, and 24-hour field programmable time clock.
5. Furnish automatic drain valve, safety relief valve, pressure gauges, and necessary valves and piping.

2.5 AIR COOLED AIR AFTERCOOLER

A. Furnish air cooled aftercooler with 1/12 HP fan and aluminum fin heat exchanger designed for continuous duty operation.

1. Fan flow rate: minimum 135 CFM minimum.
2. Motor HP: 1/12 HP, 115 VAC, single phase, 1550 RPM.

2.6 CONDENSATE SEPARATOR

A. Furnish condensate separator with automatic drain sized as necessary at low point in system downstream of air cooled air aftercooler.

2.7 PIPING

A. Compressor Tubing: Use industrial grade 316 stainless steel flexible, braided, tubing or Gates Steam Queen Industrial Hose for all above grade piping between the compressor and air cooled air aftercooler.

1. Tubing must be rated for a temperature of 400F continuous service.

B. Piping between air cooled air aftercooler and manifold piping use either 316 stainless steel flexible, braided tubing or Gates Steam Queen Industrial Hose.

- C. Manifold Piping: Use industrial grade 316 stainless steel rigid pipe for manifold for flow control meters and control valves.
- D. Aeration Hose: Use industrial grade hose sized 1/2-inch ID for all hoses between the flow meters and 1/2-inch ID air distribution tubing in pond. Approved manufacturer is Gates Adapta Flex Industrial Hose or equal.
1. Hose must be suitable for air and water applications with heat and ozone resistance.
 2. Temperature range -40F to 200F continuous service rating.
 3. Tube and cover construction material: Type P (EPDM), black.
 4. Reinforcement: Synthetic, high tensile textile cord.
 5. Fasteners: Must be constructed of stainless steel with a minimum pressure rating equal to the piping pressure rating.
 6. Hose and fasteners must be rated for direct bury.
- E. Air Distribution Tubing: Furnish 100 PSI 1/2-inch ID high density flexible PVC between aeration tubing and pond aeration modules at pond edge. Locate splice connection in 12-inch valve box.
1. Use non-leaded, self-weighted high density flexible PVC air feeder tubing from aeration piping at pond edge to aeration modules.
 2. Tubing ID=0.50", and specific gravity (SG) = 1.55.
 3. Use weighted polyethylene pipe from lake edge sleeve to pond aeration module.
- F. Pond Aeration Modules: Furnish four (4) aeration modules intended for installation on the pond bottom.
1. Pond Aeration Diffuser: Furnish Keeton Industries DDP-9 diffusers or approved equal.
- G. Piping Hardware: Furnish stainless steel clamps, fittings, nylon ties (cable ties), supports, and gaskets as required for all piping and tubing connections.

2.8 VALVES

- A. Check Valves: Furnish stainless steel check valves downstream of compressor.
- B. Isolation Valves: Furnish stainless steel ball valves for isolation of compressors.
- C. Regulating Control Valves: Furnish stainless steel ball valves where indicated on aeration flow diagram detail.

2.9 GAUGES

- A. Furnish 2.5-inch diameter liquid filled or vibration/pulsation dampened pressure gauges. Install ball valves to provide total isolation of pressure gauges.

2.10 FLOW METERS

- A. Furnish flow meters for each pond aeration module. Flow range shall be 0 to 5 CFM.
- B. Label each flow meter with the associated module and location of the module in the pond. Provide a diagram of the modules showing location and label to match the flow meters.

2.11 ELECTRICAL

A. Enclosures:

1. Mount the aeration system electrical controls in a self contained NEMA 3S enclosure with drip lip, fabricated from not less than 14 gauge steel. Furnish door gasket seals constructed from neoprene sponge, sufficient to protect interior components from weather and dust.
2. Furnish operating handle for main station power disconnect located on the front of the panel. Provide dust and weather proof enclosures for all external operating devices.
3. Mount all internal components of the enclosures on removable back panels. Do not mount components on the panel enclosure with screws that protrude from enclosure.

B. Compressor Motor Starters, Disconnect, and Electrical Switch Gear:

1. Furnish compressor motor starters contained within a single NEMA 3S enclosure with a single access door and main disconnect. Each starter must be protected on each power leg by a time delay fuse of the appropriate amperage. Motor starter coils must be 120 volt operated.
2. Use ambient-compensating type overload relays installed on each power leg set to trip at 105% of motor full-load current rating.

C. Electrical Control Panel:

1. The electrical control panel must be a NEMA 3S enclosure equipped with a gasketed enclosure door. Isolate the incoming power by means of a circuit breaker or fused disconnect.
2. The operation of the compressors must be controlled by an industrial grade, field programmable timer.

3. All starting circuits, stations safety shutdown circuits and any optional equipment control circuits shall have an operating voltage not exceeding 120 volts. All time delay control relays must be plug-in type for easy replacement.

4. Switches: The control panel must be equipped with a flow switch to disconnect the electrical power in the event of the main compressor failure. An indicating lamp on the control panel will alert the maintenance person as to the failure.

D. Aeration System Wiring:

1. All wiring from control panel to compressors must be in liquid-tight conduit with copper conductors rated not less than 600 volts AC and of proper size to carry the full load amperage of the motors without exceeding 70% capacity of the conductor. A grounding cable must be included in the liquid-tight conduit. Splices between the motor starters and the motor connection boxes are not allowed.

E. Lightning Arrestor

1. The main power supply feeding the aeration system station shall be equipped with a 3 phase secondary lightning arrestor suitably sized for system.

F. Standards:

1. All wiring shall conform to the National Electrical Code Standards.
2. Flexible conduit sections must be less than 5 feet in length to meet code. All conduits to devices must be attached securely to avoid trip hazards.
3. A wiring schematic must be provided by the manufacturer for approval prior to manufacture. The schematic shall show all devices, connections and wire numbers. Furnish a laminated copy of the schematic attached to the interior door of the panel.
4. All controls and electrical equipment must be thoroughly inspected and tested before shipment.

2.12 OTHER COMPONENTS

A. Tools and Spare Parts: Provide operating keys, servicing tools, test equipment, and any other items required.

B. Other Materials: Provide other materials or equipment required for a complete operational system, even though such items may not have been referenced in these specifications.

PART 3 -EXECUTION

3.1 INSPECTIONS AND REVIEWS

A. Site Inspections:

1. Verify site conditions and note irregularities affecting work of this section. Report irregularities to the Contracting Officer prior to beginning work.
2. Beginning work of this section implies acceptance of existing conditions.

3.2 EXCAVATION AND BACKFILLING

- A. Install and maintain safety fencing around all unattended excavation. Place safety signs adjacent to construction area.

3.3 SHIPPING AND OFF-LOADING

- A. Aeration system manufacturer must furnish and coordinate shipping and off-loading of system. Location and mounting details must be furnished to the Contractor by the aeration system manufacturer.

3.4 AERATION SYSTEM INSTALLATION

- A. Coordinate aeration system installation with irrigation pond liner replacement..
- B. Install the system as recommended by the manufacturer. Make all connections and adjustments necessary for the proper operation of the aeration system.
- C. Install compressor, filter, air cooled air aftercooler, flow meters, valves, pressure gauges, pipe, sleeves, air distribution pipe, lake aeration tubing, and lake aeration modules.
1. Install lake aeration tube as recommended by the manufacturer.
 2. Make connection between air distribution feeder pipe and lake aeration modules as recommended by the manufacturer.
 3. Install underground piping in sleeving where required. Coordinate the installation of the pond edge sleeves with the irrigation pond liner replacement.
 4. Install aeration piping in sleeving at a minimum depth of 24-inches.

3.5 INSTALLATION OF ELECTRICAL COMPONENTS

- A. Install electrical control panels and disconnect on wall of mechanical enclosure as recommended by manufacturer.
- B. Install all conduit and wiring as recommended by the manufacturer and as necessary for the proper operation of the system.

3.6 AERATION SYSTEM TECHNICAL START-UP

A. Aeration system manufacturer must conduct technical start-up of aeration system.

Procedures should include:

1. Provide detailed, written start-up procedure to Contracting Officer for review five (5) working days prior to start-up.
2. System start up and pressurization of aeration piping system.
3. Pressure, flow, and balance adjustments.

3.7 INSTALLATION OF OTHER COMPONENTS

A. Tools and Spare Parts: Prior to the Final Inspection supply operating keys, servicing tools, test equipment, and any other items required.. Additionally, supply one complete set of gaskets for the compressor, and one replacement filter cartridge for each filter assembly.

B. Other Materials: Install other materials or equipment as required to be part of the pumping system, even though such items may not have been referenced in these specifications.

3.8 MAINTENANCE AND OPERATION INSTRUCTIONS

A. Aeration System Maintenance:

1. Prior to Final Inspection, provide two training sessions to operating personnel on proper operation and maintenance of the aeration system. Training sessions should be for a period of not less than 4-hours each, scheduled on different days and cover aspects of maintaining, operating and repairing the new aeration system.

2. Unless otherwise noted, provide aeration system operation and maintenance information in a 3-ring binder with table of contents and index sheet. Provide sections that are indexed and labeled. Provide the following information:

- a. Catalog cut sheets for aeration system.
- b. Manufacturer's Operation and Maintenance manuals including complete documentation for programming and recommended settings and adjustments.
- c. Manufacturer's Technical Service Bulletins.
- d. Manufacturer's Warranty Documentation.
- e. Manufacturer's guide for troubleshooting operational problems.
- f. Recommended routine maintenance inspections for weekly, monthly and annual inspections and recommended actions for the inspections, recommended method for recording the findings of the inspections and winterization.

g. Predictive schedule for component replacement.

h. Listing of technical support contacts.

3. Operation and maintenance submittal package must be complete prior to being reviewed by the Contracting Officer. Incomplete submittals will be returned without review.

3.9 PROJECT AS-BUILT DRAWINGS

A. The Contractor is responsible for documenting installed system and all changes to the design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded.

B. Record aeration system alterations. Record work, which is installed differently than shown on the construction drawings. Record accurate reference dimensions.

C. Prior to project completion label each sheet of the project drawings (redlines) as "Record Drawing" and turn over to Cemetery Director. Completion of the Record Drawings is a prerequisite for Final Inspection.

3.10 MAINTENANCE

A. Operate and maintain aeration system for a duration of 30 calendar days from Final Inspection. Make periodic examinations and adjustments to pumping system components as necessary so as to achieve the most desirable operation.

3.11 CLEANUP

A. Upon completion of work, remove from the site all machinery, tools, excess materials, and rubbish.

B. Clean all surfaces and touch up scratches on aeration system with factory paint to match original.

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