



ADDENDUM NO. 1

Project: ITB 25-14: Westside WWTF Centrifuge Replacement Project

Date: February 27, 2025

This Addendum shall become as fully a part of the above-named project Scope of Work, specifications, deliverables, minimum requirements or qualifications, drawings, and other requirements as if therein written and shall take full and complete charge over anything therein written contained to the contrary. Each bidder shall be responsible for reading this Addendum to ascertain to what extent and in what manner it affects the work to be performed.

THIS ADDENDUM EXTENDS THE DEADLINES IN THE INVITATION TO BID AS FOLLOWS:

Event	Date
Pre-Bid Meeting	Tuesday, February 25, 2025 at 1:00 pm
Questions Due by 5:00 pm PST	Wednesday, March 12, 2025
Final Addendum Issued by 5:00 pm PST	Tuesday, March 18, 2025
Bid Opening at 11:00 am PST	Tuesday, March 25, 2025

TECHNICAL SPECIFICATIONS:

Replace pages 669-682 SECTION 46 51 15 LARGE BUBBLE MIXING SYSTEM with attached herein.

APPROVALS:



Julie Denton, Senior Procurement Specialist

Date: 02/27/2025

SECTION 46 51 15
LARGE BUBBLE MIXING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Scope

1. This section covers large bubble mixing systems for the Primary Sludge and Waste Activated Sludge Storage Tanks including compressors with integral air dryers, air receiver tank, valve panels, header supply piping, nozzle headers, nozzles, auxiliary equipment, and accessories as specified herein. Refer to Specification Section 40 61 96 for process control narratives. The system shall intermittently and sequentially inject compressed air through fixed nozzles located on the basin floor to create large bubbles which effectively mix the basin contents with negligible oxygen transfer from the mixing system to the bulk liquid.
2. The Supplier shall review the mechanical layout and instrumentation drawings within the Contract Documents that relate to the equipment specified in this Section to become familiar with the location and the set-up of the equipment specified. The Supplier shall further ensure that the equipment specified is appropriate for and coordinated with the arrangement shown on the Drawings.
3. The large bubble mixing system is controlled by one valve panel for each tank (two panels total). Each valve panel controls solenoid operated poppet valves that open sequentially, one at a time, to allow compressed air to pass into one of the nine headers at the bottom of the tank. Each valve panel has two manual timer knobs inside the cabinet. One knob sets the time between each valve activation. The other knob sets the time each valve remains open. The valve panel continually opens and closes each valve in sequence.

B. Equipment List

1. Numbered equipment, components, ancillaries and panels which are in the scope of supply of this Section are as follows.
2. Refer to the Process and Instrumentation Diagrams in the Drawings for details regarding the instruments to be provided under this Section.

Item	Equipment Number
Mixing Air Compressor No. 1	M-13071
Mixing Air Compressor No. 2	M-13072
Mixing Air Receiver Tank	M-13073
Auto-Drain Valve	M-13074
Valve Panel No. 1	M-13075
Valve Panel No. 2	M-13076

C. Performance Requirements

1. The equipment described in this Section shall meet the following design minimum operating requirements.
 - a. Tank Mixing shall be uniform throughout the tank with effective mixing confirmed through a Field Performance Test as specified.

- b. Air Distribution and balancing shall be sufficient to maintain suspended solids in a state of suspension over entire depth of the tank. The valve control modules shall allow control of firing parameters (sequence, duration, and frequency) to achieve tank mixing.
- c. Firing flow rate shall be manually adjustable via the throttling valve. Air mixing system equipment and piping shall be sized to thoroughly mix the contents of the tanks for which the systems are designed.
- d. Treatment Process:

	Primary Sludge Storage Tank	Waste Activated Sludge Storage Tank
Typical operating depth (ft)	8	8
Maximum normal operating depth (ft)	15	15
Full tank depth (ft)	28	28
Solids content range (%)	1-6	1-6
Number of Valve Panels	1	1
Minimum Number of ACVs (Air Control Valves) per Valve Panel (VP)	9	9
Minimum Number of Nozzle Headers per Tank	9	9
Minimum Number of Nozzles, Total per Tank	11494	94114
Header Supply Pipe Dia. (in.) (Note 1)	See Drawings	

Note 1. Piping between valve panel and respective nozzle headers.

2. Compressor System Performance and Design Requirements

- 1) Design Requirements:
 - a) The mixing air may be distributed in volumes ranging from 0-500 acfm at various times and channel section locations.
 - b) The compressed air equipment shall be designed for the following operating conditions:

Ambient Conditions		
Max Air temperature, F		115
Min Air temperature, F		32
Relative humidity, percent		100
Barometric pressure, psia		14.7
Compressors		
Number required		2 (duty / standby)
Maximum discharge pressure, psig		100
Capacity at operating target pressure, acfm		246194
Motor size, hp		50
Max motor shaft speed, rpm		3600
Max free field noise level measured at 3 feet, dBA (with enclosure)		75
Receivers		
Number required		1
Design pressure, psig		200
Nominal volume, gal		500

Air Dryer		
Type		refrigerated
Number required		2
Target Pressure Dew Point (°C)		7

1.02 QUALITY ASSURANCE

A. Reference Codes and Standards

1. This Section contains references to the following documents. Those documents are a part of this Section as specified and modified. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there was no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In all cases, the effective version of the local building code at the time of BID shall be considered the building code in effect.

Reference	Title
A240/A240M	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications.
A276	Standard Specification for Stainless Steel Bars and Shapes
A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe
A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

3. Definitions

- a. Basin: The structure within which mixing occurs; i.e., Tanks.
- b. Header Supply Pipe: Piping between a valve panel and respective nozzle headers.
- c. Nozzle Header: Continuous (i.e., not branched) horizontal piping with nozzles, with single inlet connection to header supply pipe and outlet connections to nozzles.
- d. Nozzle: Floor-anchored, large bubble-emitting device.
- e. Standard Cubic Feet per Minute (scfm): Air at 68° F, 14.7 psia, and 0 percent relative humidity as defined by the Compressed Air & Gas Institute.
- f. Actual Cubic Feet per Minute (acfm): Terminology to quantify volume of air at the standardized reference condition (ISO 1217) delivered to the terminal point of the compressor package.

- g. Valve Panel (VP): Control panel that controls the firing of integral solenoid valves, which intermittently emit compressed air bursts to the respective header supply pipes.

B. Unit Responsibility

- 1. The Supplier shall accept Unit Responsibility in accordance with Section 43 05 11 to warrant, design, manufacture, Factory Test, ship, provide coordination of installation, provide all specified Field Testing and Commissioning, Training, and Operations and Maintenance Manuals for all the equipment specified in this Section. A Certificate of Unit Responsibility Form shall be furnished for the equipment specified in this Section.

C. Factory Testing

- 1. Factory Testing shall be performed by the Supplier prior to delivery to verify the accuracy and performance of the systems as specified. Factory Testing need not be witnessed by the Engineer unless a special Witness Testing paragraph is included in this Section. However, the Supplier shall certify and provide copies of the tests and guarantee the equipment's performance as specified in this Section. All certifications of Factory Testing shall be submitted and approved by the Engineer, prior to shipping equipment.
- 2. Factory Testing shall include at the minimum all standard tests recommended by the Supplier and the following:
 - a. Compressor Shop Test
 - 1) Prior to shipment each compressor module shall be operated to check alignment; faulty equipment and controls; proper wiring; leaks in piping, seals, or welds; and proper operation of the safety and operating controls. Compressor pressure controls shall be adjusted to the specified pressures. Defective equipment and controls disclosed by such tests shall be replaced and the package placed in satisfactory operating condition before shipping.

D. Warranty

- 1. A warranty for the equipment specified under this Section shall be provided in accordance with the General Conditions. The Large Bubble Mixing Manufacturer shall guarantee the equipment against defects in materials and workmanship under normal use and service, to the original purchaser, for a period of twelve (12) months from date of equipment startup by an authorized technician.

1.03 AREA EXPOSURE DESIGNATIONS AND ENVIRONMENTAL CONDITIONS

- A. Refer to Section 01 61 45 – Area Exposure Designations and Environmental Conditions for site-wide area exposure designations and environmental conditions.
- B. The equipment specified in this Section will be located as shown on the drawings.

1.04 SUBMITTALS

- A. Preconstruction/Action Submittals: The following minimum submittals shall be submitted prior to construction of this element of the Work in accordance with Section 01 33 00 - Submittal Procedures.
 - 1. Catalog data or illustrations showing principal parts and materials.
 - 2. Detailed layout drawings.

3. Control System information including the following:
 - a. Detailed product information for all control system instruments, components, and control devices.
 - b. Control system panel construction and layout drawings including dimensions and net weight of panel, mounting and installation details, power and control cable type and size, wiring diagrams, schematics, bill of materials, and requirements for all field connections.
 - c. Drawings of control panel furnished in accordance with Division 26, Electrical.
 4. Operating and maintenance instructions and parts list
 5. Compressor support locations and loads transmitted to bases and foundations.
 6. Compressor electrical schematics and field termination wiring.
 7. List of recommended spare parts other than those specified.
 8. Field inspection reports.
 9. Qualifications of field service engineer.
 10. Recommendations for short and long-term storage.
 11. Testing procedures.
 12. Special tool requirements.
- B. Informational Submittals: The following minimum informational submittals shall be submitted in accordance with the timing requirements specified in these Contract Documents, prior to Substantial Completion and in accordance with Section 01 33 00 - Submittal Procedures.
1. Operations and Maintenance Manuals (including Warranty) in accordance with Section 01 78 23.
 2. Factory Test Reports
 3. Field Testing Plan
 4. Certificate of Proper Installation
 5. Field Test Reports
 6. Certificate of Field Testing and Commissioning
 7. Certificate of Training Completion

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Suppliers
1. The Engineer and Owner believe that the following Suppliers can produce equipment and products which will satisfy the requirements of this Section.
 - a. EnviroMix, Inc.
 - b. Approved equal
 2. The large bubble mixing system shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods. The Contractor shall obtain the nozzles, nozzle headers, air header supply piping, valve panels, air receiver tank, compressors, and appurtenances from the mixing system manufacturer, as a

complete and integrated package to insure proper coordination and compatibility and operation of the system.

2.02 STRUCTURAL DESIGN REQUIREMENTS FOR EQUIPMENT

- A. Equipment shall be provided in accordance with Section 01 73 24 - Design Requirements for Non-Structural Components and Non-Building Structures.

2.03 MATERIALS

- A. Materials used for the construction of the equipment provided under this specification shall be as specified below.
- B. Materials specified are considered the minimum acceptable for durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength, corrosion resistance or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose. If alternatives are proposed, the proposals shall be accompanied with documentation supporting the claimed superiority of the proposed substitutions. The Engineer shall be the sole decider in the equivalency of alternative materials of construction.

2.04 EQUIPMENT

- A. Tubing and fittings with a minimum thickness less than schedule 5 is not allowed.
- B. Header Supply Piping. Provide piping from each valve panel to the nozzle headers, including piping supports, anchors, isolation valves and fittings.
 - 1. Header supply piping shall be Sch 5S or 10S, stainless steel press technology system (Victaulic, Viega, or equal), comprised of stainless steel press technology fittings, couplings, and pipe, unless specified otherwise.
 - 2. Maximum working pressure of 150 psi.
 - 3. Couplings and fittings: Press technology products formed of Type 316/316L stainless steel tubing including a self-contained o-ring seal(s) molded of synthetic FKM rubber, EPDM, or HNBR.
 - 4. Pipe: Type 316/316L ASTM A312 stainless steel.
 - 5. Provide pipe supports consisting of Type 316 stainless steel strut channel with Type 316 stainless steel cushion clamps.
 - 6. Anchors: 316 stainless steel mechanical wedge anchor. Provide epoxy or adhesive anchors for all submerged or potentially submerged locations.
- C. Nozzle Headers. Provide piping, fittings, supports and anchors from the header supply piping to the nozzles.
 - 1. Sch 10S, 316/316L stainless steel with 1" Sch 40S, stainless steel nozzle offsets
 - 2. Nozzle couplings: 1" NPT, 150 lb, 316/316L stainless steel
 - 3. Delivered from the Manufacturer pre-assembled to the extent practicable to minimize field assembly error and installation time.
 - 4. Pipe: Type 316/316L ASTM A312 stainless steel.

5. Provide nozzle headers in maximum 20-ft segments with two bolt 316/316L stainless steel flexible gasketed coupling connections. Flexible couplings shall be rated for a maximum working pressure of 150 psi.
6. Provide nozzle headers with removable end caps to facilitate clean-out.

D. Nozzles

1. Top plate fabricated from 14 gauge stainless steel plate, ASTM A240/A240M, Type 316/316L with a 2D finish.
2. Bottom channels welded to the top plate and fabricated from 16 gauge stainless steel plate, ASTM A240/A240M, Type 316/316L.
3. Nozzles shall be designed with adequate strength to withstand vertical thrust of mixing air.
4. Threaded Rod Anchors & Adhesive:
 - a. Four 3/8" diameter threaded rods with a minimum of 3" embedment shall be installed per nozzle.
 - b. Adhesive for the threaded rod shall be provided by the Contractor. Adhesive shall be true epoxy by Hilti HIT-RE 500, Dewalt Pure 110+/220+ or Simpson SET-3G. Acrylic adhesive by Hilti HIT-HY 200, Dewalt AC200+ and Simpson AT-3G acceptable if required for installation temperatures. Follow manufacturer hole preparation requirements and installation instructions.

E. Automated Drain Valves

1. Electronic no-loss drain valve of Ingersoll Rand, Atlas Copco, or approved equal shall be installed under the free standing air receiver.

E. Appurtenances

1. Miscellaneous: Nuts, bolts, washers, threaded rod, and other non-welded parts shall be stainless steel, ASTM A240/A240M, Type 316. Threaded assemblies shall be chemically treated or lubricated prior to assembling to prevent galling.

G. Fabrication

1. The piping used for the air mixing system shall be Type 316/316L stainless steel unless otherwise noted.
2. Shop fabricate welded metal parts and assemblies from stainless steel, ASTM A240/A240M, Type 316/316L with a 2D finish.
3. Shop fabricate non-welded parts and pieces from sheets and plates of stainless steel, ASTM A240/A240M, Type 316 or from bars of stainless steel ASTM A276, Type 316, unless specified otherwise.
4. Welds and Welding Procedure
 - a. Shop weld with filler wire using MIG, TIG or shield-arc, or plasma-arc welding inert gas processes. Provide a cross-section equal to or greater than parent metal thickness.
 - b. Provide full penetration welds to interior surface with gas shielding to interior and exterior of joint.
 - c. Provide smooth, evenly distributed interior weld beads with an interior projection not exceeding 1/16 inch beyond inner diameter of nozzle header or fittings.
 - d. Field welding is not permitted.

- e. Clean all welded stainless steel surfaces and welds after fabrication to remove weld splatter and finish clean all exterior welds, carbon deposits and contaminants per ASTM A380 Section 6.2.11

H. High Pressure Air Compressors

1. Two (2) air compressor modules shall be provided as noted in the Design Table. Each module shall include an inlet air filter, compressor with an AC motor, air/oil separator reservoir, air cooled oil cooler, cooling fan, separator pressure relief valve, discharge check valve, filters, controls, control panel, base, and unloading system.
2. Each compressor module shall be completely factory assembled requiring only field connection of electrical power, and air and condensate drain piping.
3. Each compressor shall be of the single stage, positive displacement, oil-flooded, rotary screw type. The compressor shall be provided with an integral skid or lifting lugs for unloading and placement.
4. Each compressor rotors shall be asymmetrical, steel or high strength ductile iron integral shafts, and dynamically balanced. Housings shall be cast iron. Rotors and housings shall be precision machined for accurate bearing positioning and running clearances. The male rotor shall have a geared connection to the drive motor in a manner which will ensure permanent alignment.
5. Radial bearings shall be cylindrical roller type. Thrust bearings shall be in accordance with the manufacturer's recommendations. Bearing life shall be manufacturers standard over 90,000 hours.
6. Positive pressure lubrication shall be provided by an inherent pressure differential system. Lubricant shall be provided as recommended by the manufacturer. A lubricant filter shall have a high-capacity 10 micron rating.
7. An air/oil separator reservoir shall be provided for each compressor. The reservoir shall be designed and constructed in accordance with the ASME Code for Unfired Pressure Vessels and shall bear the code stamp. The reservoir shall include two-stage filtration to remove oil from air stream.
8. Each air compressor module shall have automatic controls integral to the unit which open (loaded condition) and close (unloaded condition) the inlet valve to the air end to deliver appropriate volume to meet demand and maintain system target pressure. On sensing a low demand, the motor will keep running but the air end inlet valve will close, resulting in a decreased "idling" power draw on the motor. The valve shall reopen when system pressure drops below the set point.
9. Each baseplate shall be constructed of one-piece folded mild-steel with structural members and shall be designed for no measurable deflection with the equipment mounted thereon and the baseplate supported around its perimeter. Each base shall be designed so that all equipment bolted to it can be removed without access to the underside of the plate and with a flat top surface for ease of cleaning. Structural stiffeners shall be located under the compressors at the compressor anchor points.
10. Valves and piping within the enclosure shall be the compressor manufacturer's standard. Relief valves shall be provided for equipment protection on the air and coolant systems as required.
11. Each compressor shall be provided with an integral, dry-type intake filter. Intake filters shall have replaceable filter element(s). Particle arrestance shall be not less than 99.9% efficient at 10 microns and above.
12. Each compressor shall be supplied in a sound attenuated enclosure. The enclosure shall reduce the measured sound to a maximum of 75 decibels, as measured by ISO

8571, while the compressor is operating and the sound level is measured a distance of three feet from the enclosure.

13. Each compressor electrical control cabinet shall be a NEMA 1 rated enclosure and supplied with an emergency shutdown pushbutton.
14. A high air/fluid temperature shutdown system shall be provided. The unit must have safety devices mounted and wired. Safety devices shall include high compressor discharge temperature shut-down. These systems must be designed to prevent the compressor from running in an over temperature situation or motor from running in an overload condition.
15. Each compressor shall be as manufactured by Atlas Copco, Model GA~~3730-FF~~, or equal.

L. Free Standing Air Receiver

1. One nominal 500-gallon air receiver shall be provided. The receiver shall be designed and constructed in accordance with the ASME Code of Unfired Pressure Vessels and shall bear the code stamp.
2. Receiver shall be factory powder coated. One quart of touch-up paint shall be provided.
3. The receiver shall be provided with mounting feet and pressure gauge.
- ~~4. Provide a pressure transducer on the receiver supply pipe and wired to transmit the supply pressure measurement to the PLC. Refer to Section 40-61-13.01 INSTRUSPEC PGT for instrument details.~~
- 5.4. The receiver shall be provided with an automated drain valve per paragraph 2.04.F.

J. Refrigerated Dryer

1. An air dryer shall be provided of refrigerated air type. The dryer shall produce ~~an ISO Class 537-39, 7°C~~ pressure dew point at the dryer exit when operating continuously at the rating conditions of ~~100 psi and 2°C-100°F inlet air ambient temperature and RH of 60%.~~
2. The dryer shall be able to continuously dry the air compressor's maximum discharge capacity.
3. The dryer shall be integral to the compressor package.
4. The dryer ~~requires a 480VAC power supply derived from the compressor power supply. Utilizes~~ shall use a transformer that is integral to the compressor to acquire the proper power supply.

K. Coalescing Filter

1. A coalescing filter shall be provided for the compressor. The coalescing filter shall be designed to remove liquid aerosols from the compressed air supply. The filter shall be effective to 1 micron for particles and liquid aerosols to 1.0 ppm at 70°F.
2. The coalescing filter shall have an aluminum housing, NPT connections, and automatic condensate drain.
3. The coalescing filter shall be rated for the maximum capacity of the air stream it is treating.

2.05 ELECTRICAL COMPONENTS AND ACCESSORIES

- A. Electrical components and control panels shall be listed for the purpose for which they are to be used by an independent testing laboratory acceptable to the inspection authority having jurisdiction in accordance with Section 26 05 00.
- B. Compressor System Electrical
 - 1. All electrical and control equipment for the air compressor module shall be furnished as required for a complete installation, requiring only field connection of 480 VAC, three phase power supply
 - 2. The compressor electric motor shall be rated 480 volts, 60 Hz, three phase in accordance with Section 43 05 21 – Common Motor Requirements for Equipment.
- C. Compressor System Control Panel – An enclosure-integrated control panel mounted on the compressor module shall include:
 - 1. Full voltage, non-reversing, or wye-delta motor starters sized as required by the manufacturer
 - 2. Control power transformers shall have both primary leads fused, one secondary lead fused, and one secondary lead grounded.
 - 3. Terminal blocks for all system wiring. Internal panel wiring shall be neatly bundled and tied and shall be identified with suitable wire markers
 - 4. Gauges and indicators shall be provided to indicate the following conditions at a minimum; compressor discharge pressure indication, compressor discharge temperature high shutdown alarm indication, inlet filter differential pressure indication, compressor overload alarm indication, power on, hours of operation, operating mode. The compressor system control panel shall contain pushbuttons for local start and stop and alarm reset.
- D. Circuit Protection
 - 1. Vendor shall provide control panel minimum continuous ampere rating for circuit conductor sizing. Maximum circuit breaker or fusing requirements shall be provided to coordinate with upstream disconnect and feeder circuit sizing.
 - 2. Vendor submittal shall state the short-circuit current rating (SCCR) of the control panel in accordance with NEC 409.22.

2.06 INSTRUMENTATION AND CONTROLS

- A. Valve Panel (VP) Enclosure. Valve control panels shall be a NEMA 4X 316 stainless steel enclosure and the complete VP assembly shall be listed by an independent testing laboratory to the UL 508A standard. Valve panels shall be white powder coated from the factory. Valve panel shall be sized to provide heat dissipation such that, at a 110 degree F ambient temperature, the operating temperature rating of the lowest-rated component in the panel is not exceeded.
 - 1. Power Connection. All valve panels shall accept a single source 120 VAC power connection. Lightning and surge protection shall be provided on the incoming line power. Lightning and surge protection shall be Phoenix Contact Mains Plugtrab or equal.
 - 2. Air Control Valves (ACV). The air control valves shall be poppet style valves, mounted to a common manifold. The valves shall have a life expectancy of 15,000,000 cycles. Valves shall vent to the outside of the panel.

3. Throttling Valve. The valve panel shall be equipped with a throttling valve to adjust the volume of air released to the ACVs and corresponding header supply piping. The throttling valve shall be pre-plumbed into the valve panel.
- B. Valve Panel Enclosure
1. Each valve panel enclosure shall have an internally mounted LOCAL-OFF-REMOTE switch.
 2. When in 'Local' mode, a 'Frequency' potentiometer, and a 'Duration' potentiometer shall be used to make valve operating parameter changes to the local controller. When in 'Remote' mode, the plant PLC will control each zone independently similar to 'Local' mode. When the switch is in the 'Off' position, the panel cannot be operated locally or remotely.
 3. Mixing Parameters. Minimum control features shall include the following:
 - a. Valve Status – Enable / Disable functionality of individual valves shall be provided.
 - b. Duration – Selection of the length of time an individual ACV is open during a firing. This value shall be adjustable and have a minimum value of 100 milliseconds and a maximum value of 10,000 milliseconds.
 - c. Frequency – Selection of the frequency at which an individual ACV is firing. This value shall be adjustable and have a minimum value of 1,000 milliseconds and a maximum value of 60,000 milliseconds.
 - d. Firing Sequence – Sequence depicting the firing order of each ACV controlled by the panel.
 4. Pressure Alarms. Each valve panel shall come equipped with a ~~pressure transducer~~ low pressure switch plumbed to the valve manifold. The alarm light will illuminate, and a dry contact shall be provided for remote indication of low pressure.

2.07 SAFETY ENCLOSURES AND MEASURES

- A. Equipment shall have adequate removable enclosures to protect personnel against accidental contact with moving parts and prevent dripping in multilevel installations in accordance with the guards and caution sign requirements in Section 43 05 11.

2.08 NAMEPLATES

- A. Equipment nameplates shall be provided on each item of equipment, including the primary equipment supplied, valves, operators and all other major appurtenances that are part of the scope of supply of this Section. Unless otherwise specified, equipment nameplates shall be provided in accordance with technical requirements described in Section 43 05 11.
- B. Electrical nameplates shall be provided on each electrical item supplied including control panels and variable frequency drives which are part of this Section's scope of supply. Unless otherwise specified, electrical nameplates shall be provided in accordance with the technical requirements of Section 26 05 00.
- C. Motor nameplates shall be provided on each motor supplied which are part of the scope of supply of this Section. Unless otherwise specified, motor nameplates shall be provided in accordance with the technical requirements of Section 43 05 21.

- D. The nameplate shall be securely fastened in a conspicuous place and clearly inscribed with the manufacturer's name, year of manufacture, and serial number.

2.09 ANCHOR BOLTS

- A. Furnish all anchor bolts in accordance with Section 05 05 20 – Anchor Bolts of ample size and strength required to securely anchor each item of equipment in accordance with Section 05 05 20 Anchor Bolts.
- B. Provide anchorage and seismic design in accordance with Section 01 73 24 Design Requirements for Non-Structural Components and Non-Building Structures.

2.10 NOISE LIMITS

- A. Not Applicable.

2.11 COATINGS

- A. All components of the compressed air equipment system shall be shop primed and finish painted with the manufacturer's standard paint system prior to shipment to the site.

2.12 SPARE PARTS

- A. Provide spare parts that are identical to and interchangeable with similar parts installed.
 1. One (1) Air Control Valves (ACVs) rebuild kit
 2. One (1) pilot air filter assembly
 3. One (1) solenoid
 4. One (1) valve plug and cable assembly
 5. One (1) 5-micron pilot air filter
 6. One (1) compressor intake air filter element per compressor provided
 7. One (1) compressor air-oil separator filter element per compressor provided
 8. One (1) each compressor primary/secondary element per compressor provided
 9. One (1) set of manufacturer's standard stock of spare parts for each size and type of electric motor operator provided.
 10. Three (3) of each type/size of fuse used.
 11. One (1) of each type/size breaker used.
 12. One (1) valve control panel back-up controller.

PART 3 EXECUTION

3.01 SHIPMENT AND STORAGE

- A. Equipment shall be shipped and stored in accordance with Section 01 66 00.
- B. Supplier shall provide Contractor with detailed recommendations and instructions for equipment storage.

3.02 INSTALLATION

- A. Install items in accordance with approved shop drawings, manufacturer's printed instructions and as indicated.
- B. All nozzles on respective nozzle header shall be level within ½-inch of a common horizontal plane.

3.03 MANUFACTURER'S FIELD SERVICES

- A. The services of a qualified manufacturer's technical representative shall be provided for installation inspection, testing, startup and training. The mixing system manufacturer shall include the following site visits and days on site:

Service	Number of Trips	Number of Days/Trip
Installation Inspection and Testing	2	2
Compressor Installation Inspection and Testing	1	1
Startup and Training	1	1

- B. The training shall consist of, at minimum, 1 hour per classroom and 1 hour per field training for operations and maintenance staff (total of 2 hours of training).

3.04 FIELD TESTING AND COMMISSIONING

- A. All mixing components shall be field tested with the respective tanks full to the maximum water surface elevation.
- B. Exposed air piping shall be tested by Contractor for leaks using soapy water on all joints and applying 140 psi test pressure. Air piping in the tanks may be tested by submersing the piping in non-potable water and pressurizing the piping to 40 psi, in lieu of using soapy water on all joints. Pressure testing requirement shall not apply to supply piping downstream from valve panel or pre-manufactured nozzle headers.
- C. The Contractor shall operate each mixing system at the maximum water surface elevation in the tanks for a continuous period of not less than 72 hours. The CONTRACTOR shall correct and resolve all operating problems, deficiencies, etc., determined by the tests.
- D. After the above testing is complete, field mixing performance testing of the installed Air Mixing System shall be performed by the manufacturer as described below.
 - 1. Mixing performance testing shall be conducted in the PS Storage Tank and WAS Storage Tank.
 - 2. All personnel and equipment necessary to conduct and supervise all testing shall be provided by the mixer manufacturer. Engineer and Owner shall be notified of the test to witness at their option and expense.
 - 3. Prior to performing the tests, the tank which will be tested must have been in normal operating mode for at least two days with total solids content in typical operating ranges of (1-6%). No flow shall enter or exit the respective basin for 8 hours prior to and during the test.

4. The large bubble gas mixing system manufacturer shall conduct total suspended solids (TSS) testing using a Cerlic TSS Probe, or equal, suspended solids analyzer.
5. Testing Procedure:
 - a. Four horizontal-plane sample sites to be tested shall be selected by the Engineer. At each sample site, three vertical samples shall be collected as follows: 24-inches from the surface, tank sidewall mid-point and 24-inches above the tank sidewall bottom. The samples for each location shall be analyzed as described above.
 - b. The Coefficient of Variation (Cv) shall be determined for the sample set, excluding the maximum and minimum samples. The Cv shall be calculated by taking the resultant set of ten (10) samples as follows: $Cv = (100 \times \text{Standard Deviation of Ten Samples}) / (\text{Mean Value of Ten Samples})$.
 - c. If the Cv is less than or equal to 10%, then the mixer performance shall be acceptable for that location.
- E. If the Cv is greater than 10%, then the mixer performance shall be unacceptable for that location and the Contractor and/or Manufacturer shall make all necessary improvements (at no additional cost to Owner) and repeat the testing procedure at no additional cost to Owner until the Cv is less than or equal to 10% for that location.

END OF SECTION