

## DOCUMENT 00 01 10

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## SECTION 08 45 13

## TRANSLUCENT WINDOW SYSTEM

**PART 1 GENERAL****1.01 SUMMARY**

- A. Section includes requirements for translucent window system as shown and specified herein.

**1.02 WORK INCLUDED**

- A. Design, engineer, manufacture, and installation of translucent window system.
- B. All anchors, brackets, and hardware attachments necessary to complete the specified structural assembly, weatherability, and water-tightness performance requirements. All flashing up to but not penetrating adjoining work are also required as part of the system and shall be included.
- C. Trained and factory authorized labor and supervision to complete the entire panel installation.

**1.03 RELATED WORK ELSEWHERE**

- A. Sheet Metal and Flashing
- B. Sealant

**1.04 QUALITY ASSURANCE**

- A. The glazing panels must be evaluated and listed by recognized building code evaluation organization: International Council Evaluation Service Inc (ICC-ES).
- B. Materials and products shall be manufactured by a company continuously and regularly employed in the manufacturing, engineering, and designing, stocking and building of unitized translucent window/walls for a period of at least ten (10) years.
- C. Erection shall be by an installer who has been in the business of erecting similar material for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope, and type.
- D. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, in accordance with the requirements of this specification.

**1.05 SUBMITTALS**

- A. Submit Shop drawings and color samples.
- B. Manufacturer shall submit written guarantee accompanied by substantiating data, stating that the products to be furnished are in accordance with or exceed these specifications.
- C. Manufacturer shall submit full warranty and sales terms and conditions for verification of compliance with the requirements of this specification.
- D. Submittal: For glazing assemblies to comply with performance requirements and design criteria,

**1.06 MAINTENANCE DATA**

- A. The manufacturer shall provide recommended maintenance procedures, schedule of maintenance and materials required or recommended for maintenance.
- B. Submit installer certificate signed by installer, certifying compliance with project qualification requirements.

**1.07 WARRANTY**

- A. Provide a single source translucent window systems manufacturer warranty against defective materials and fabrication. Submit manufacturer's written warranty agreeing to repair failures in materials within one (1) year from date of delivery.
- B. Provide the following single source translucent window manufacturer glazing warranties. Third party warranties shall not be acceptable. All warranties shall be maintained without any system maintenance requirements of the owner's responsibility. The expected humidity of the enclosed space shall not affect warranty length.
  - 1. Provide a lifetime warranty for both interior and exterior glazing covering:
    - a. Delamination of the glazing from the internal structure.
    - b. Fiberbloom; development of a rough exterior surface.
  - 2. Provide a ten (10) warranty on the interior glazing covering:
    - a. Change in light transmission of no more than 6 percent per ASTM D1003.
    - b. Color stability: interior glazing shall not change color more than 6 CIE Units DELTA E by ASTM D2244.
  - 3. Provide a ten (10) year warranty on the exterior glazing covering:
    - a. Change in light transmission of no more than 6 percent per ASTM D1003.
    - b. Color stability: exterior glazing shall not change color more than 6 CIE Units DELTA E by ASTM D2244.
  - 4. Blue light spectrum (400-470nm) measured in accordance with ASTM E1175 shall not decrease by no more than 6 percent after ten years in comparison with the original value.
- C. In addition, submit installer's written warranty agreeing to repair installation workmanship, defects and leaks within one year from date of delivery.

**PART 2 PRODUCTS****2.01 MANUFACTURER**

- A. Basis of design
  - 1. The design and performance criteria of this job are based on the UniQuad Translucent Window—prefabricated, pre-assembled glazing, system as manufactured by Kingspan Light + Air | Architectural Daylighting
  - 2. Phone: (800) 759-6965 Website: [www.kingspanlightandair.us](http://www.kingspanlightandair.us)
  - 3. [WindowTherm by SIP as an approved product; Contract Bruce Gold, Solutions in Polycarbonate, LLC. Phone: 330.572.2860.](#)
- B. Approved Manufacturers
  - 1. Other manufacturers may bid this project provided they comply with all requirements of the specification and submit evidence of compliance with all performance criteria specified herein. This evidence must include proof of conformance and test reports per Section 1.5. Any exceptions taken from this specification must be noted on the approval request. If no exceptions are noted and approval is given, product performance will be as specified.
  - 2. Listing manufacturers names in this specification does not constitute approval of their products or relieve them of compliance with all the performance and design requirements contained herein.

**2.02 TRANSLUCENT WINDOW PERFORMANCE AND APPEARANCE**

- A. Glazing construction for longevity and resistance to buckling and pressure.
  - 1. Translucent glazing must be constructed of tight cell sizes not exceeding 0.18 inch. Wide cells of size greater than 0.18 inch shall not be acceptable.
- B. Translucent glazing assemblies – Unitized Double Glazed
  - 1. Design, engineer, manufacture, and installation of unitized double-glazed translucent window system. An assembly of two independent insulated glazing panes in one integrated assembly, incorporated into a complete aluminum frame system that has been tested and warranted by the manufacturer as a single source system. Design shall provide for the replacement of the exterior glazing, independently of the interior glazing without exposing the building's interior or

- compromising the weather tightness of interfering with the normal working functions of the building. Single pane glazing systems are not acceptable.
2. Overall glazing assembly thickness shall be a minimum 2.75 inches, with two glazing panes and concealed interlocking connector. Thickness of the exterior and interior glazing shall be minimum 8mm thick each.
- C. Thermal and Solar Performance
1. To ensure Energy Code compliance, product U-Values must be listed in the NFRC Product Directory and have a Certified Product Directory (CPD) number.
    - a. Basis of Design CPD Number: UQTW
  2. Center of glazing U-Value per NFRC 100: Maximum .25.
  3. System U-Value per NFRC 100 and 700: Maximum .30.
  4. Haze measurement minimum of 90 percent per ASTM D1003.
  5. Standard exterior glazing color: Clear Matte
  6. Standard interior glazing color: Clear Matte
- D. Translucent Glazing Joint System
1. Water penetration: no water penetration of the glazing joint connection length at test pressure of 6.24 PSF per ASTM E331.
  2. Air Infiltration: pass requirements of NFRC 400 at 1.57 PSF and 6.24 PSF.
  3. Air Exfiltration: pass requirements of NFRC 400 at 1.57 PSF and 6.24 PSF.
  4. Free movement of the glazing shall be allowed to occur without damage to the weather tightness of the completed system.
  5. The glazing joint shall comply with the deflection limitation of IBC Table 1604.3 for exterior walls with flexible finishes – L/120 per IBC.
- E. Flammability
1. Exterior Glazing
    - a. Class A interior flame spread per ASTM E84
    - b. Flame spread no greater than zero (0) and smoke density no greater than 110 per ASTM E84.
    - c. Minimum self-ignition temperature of 1120° per ASTM 1929.
  2. Interior Glazing
    - a. Class A interior flame spread per ASTM E84.
    - b. Flame spread no greater than zero (0) and smoke density no greater than 110 per ASTM E84.
    - c. Minimum self-ignition temperature of 1120° per ASTM 1929.
- F. Impact Resistance
1. Minimum Impact loading of 500 ft. lbs. per ASTM E695.
- G. Weatherability
1. The light transmission shall not decrease more than 6 percent as measured by ASTM D1003 over 10 years, or after exposure to temperature of 300° for 25 minutes (thermal aging performance standard).
  2. The weathering performance should be justified by successful testing of the glazing's performance after exposure to actual Florida weather conditions for approximately 10 years in comparison to a new glazing assembly. This performance must be demonstrated by providing independent lab test reports for the exposed and a new panel assembly for the following tests; test results must show that there is no deterioration in performance for the 10 year's exposed panels versus new:
    - a. Uniform static air pressure per ASTM E330 at negative load of -105 PSF and positive load of 130 PSF.
    - b. Impact loading of 500 feet pounds per ASTM E695.
    - c. Cyclic static air pressure at 65 PSF and impact lever D per ASTM 1886 and ASTM E1996.
  3. Glazing must be manufactured with a permanent, co-extruded ultra-violet protective layer. Post-applied coatings or films of dissimilar materials that need to be maintained are unacceptable.
  4. Glazing shall not become readily detached when exposed to temperatures of 300°F and 0°F for 25 minutes.



5. Thermal aging – the interior and exterior glazing shall not change color in excess of 0.75 Delta E per ASTM D2244 and shall not darken more than 0.3 units Delta L per ASTM D2244 and shall allow no cracking or crazing when exposed to 300°F for 25 minutes.
6. Glazing shall be factory sealed to restrict dirt ingress.

### **2.03 METAL FRAME STRUCTURE**

- A. The wall light framing is designed to be self-supporting between the support constructions. The deflection of the system framing members in a direction normal to the plane of the glazing, when subjected to a uniform load deflection, shall not exceed L/120 for the unsupported span per IBC Table 1604.3. All adjacent and support construction must support the transfer of all loads included horizontal and vertical, exerted by the system. Design or structural engineering services for the supporting structure or building components in not included in the translucent window scope of this section.
- B. All window system aluminum framing exposed to the exterior shall be thermally broken.
- C. Water penetration: the translucent window system shall allow no water penetration at a minimum differential static pressure of 6.24 PSF per AAMA 501 pressure difference recommendations and as demonstrated by prior testing of typical framing sample per ASTM E331
- D. Water test of metal frame structure shall be conducted according to procedures in AAMA 501.2.

### **2.04 METAL MATERIALS**

- A. Extruded aluminum shall be ANSI/ASTM B221; 6063-T6 or 6005-T5.
- B. Flashing:
  1. 5005 H34 Aluminum .040-inch thick
  2. Sheet metal sill flashings are to be furnished shop formed to profile - when lengths exceed 10 feet, provide in nominal 10ft lengths. Field trimming of the flashing and field forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap at least 6 inches to 8 inches, set in a full bed of sealant and riveted if required.
- C. All fasteners for aluminum framing to be stainless steel or cadmium plated steel, excluding the final fasteners to the building.
- D. All exposed ALUMINUM FINISH shall be from manufacturer standard color range:
  1. Options as follows:
    - a. PREMIUM polymer resin powder coat per AAMA 2604 with 10-year warranty.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. General contractor to verify when structural support is ready to receive all work in the section and to convene a pre-installation conference at least one week prior to commencing work of this section. Attendance required of the general contractor, translucent window installer and all parties affecting and effected by the work of this section.
- B. All submitted opening sizes, dimensions and tolerances are to be field verified by the general contractor unless otherwise stipulated.
- C. Installer shall examine area of installation to verify readiness of site conditions. Notify the general contractor about any defects requiring correction. Do not work until conditions are satisfactory.

### **3.02 INSTALLATION**

- A. Install components in strict accordance with manufacturer's instructions an approved shop drawings. Use proper fasteners, caulking and hardware for material attachments as specified.
- B. Use methods of attachment to structure allowing sufficient adjustment to accommodate tolerances.
- C. Remove all protective coverings on panels immediately after installation.



**3.03 CLEANING**

- A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, cleaning wiping cloths. Always test a small area before applying to an entire area.
- B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use. Always test a small sample to validate compliance before applying to the entire glazing surface.
- C. Installer shall leave glazing system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

**END OF SECTION**

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## SECTION 11 53 13

## LABORATORY FUME HOODS

**PART 1 GENERAL****1.01 SUMMARY**

- A. Provide:
  - 1. Laboratory Ductless Benchtop Fume hood.
- B. Related Sections:
  - 1. 12 30 00 Manufactured Casework - Metal and Resin

**1.02 SUBMITTALS**

- A. Refer to Section 01 33 00.
- B. Product Data: Submit manufacturer's current Product Data including specifications, handling, storage and installation instructions, and maintenance and cleaning recommendations.
- C. Maintenance Manual: Provide to Owner, maintenance and warranty data in "Maintenance Manual" compliant with Section 01 77 00 at Maintenance Demonstration at Substantial Completion.

**1.03 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide materials made of components, with uniform texture and color or blend, furnished by 1 manufacturer for each different product required.
- B. Qualifications:
  - 1. Contractor: 3 years experience in the installation of laboratory equipment.
  - 2. Personnel: For actual installation of laboratory equipment, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

**1.04 PROJECT CONDITIONS**

- A. Existing Conditions: Drawings do not purport to show actual dimensions but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

**1.05 MAINTENANCE**

- A. Extra Materials: Provide for maintenance purposes, 2 additional HEPA filters. Deliver and store as directed by Owner.

**PART 2 PRODUCTS****2.01 MANUFACTURER**

- A. Standard of Quality: Design is based on products of Labconco Corporation, Kansas City, MO [www.labconco.com](http://www.labconco.com)
- B. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
  - 1. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

**2.02 COMPONENTS**

- A. Filtered Benchtop Fume Hood:
  - 1. Dimensions: 48-inch wide by 37.7-inch deep by 66.2-inch high.
  - 2. Electrical: 115V, 50/60 Hz, 10A.
  - 3. Airflow Type: Bypass.
  - 4. Air foil Type: Eco-Foil.
  - 5. Integral Blower.
  - 6. Conformance: AFNOR NF-X, ANSI Z9.5, ASTM E84, CAN/CSA C22.2, Modified ASHRAE 110, SEFA 9, UL 61010.
  - 7. LED Lighting.
  - 8. 11.75-foot power cord with plug.
  - 9. Sash Type: Cable and pulley.
  - 10. Style: Benchtop with 48-inch wide base cabinet.
  - 11. Dished epoxy top and left rear cup sink.
  - 12. Neutrodine Unisorb filter, HEPA filter, replacement ammonium pre-filter.
  
- A. Accessories:
  - 1. Other Materials: Materials not specifically described but required for complete, proper installation of equipment, subject to acceptance of Engineer.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. Clean surfaces thoroughly prior to installation.
  
- B. Install in accordance with manufacturer's instructions, approved submittals and in proper relationship with adjacent construction. Secure work surfaces to casework securely. Test for proper operation and adjust until proper operation is achieved.

**3.02 PROTECTION**

- A. Protect installed products until completion of project.
  
- B. Touch-up, repair or replace damaged products before Substantial Completion

**END OF SECTION**

## SECTION 22 15 13

## GENERAL-SERVICE COMPRESSED-AIR PIPING

**PART 1 GENERAL****1.01 SUMMARY**

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig (1035 kPa) or less.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For the following:
  1. Pressure regulators. Include rated capacities and operating characteristics.
  2. Automatic drain valves.
  3. Filters. Include rated capacities and operating characteristics.
  4. Lubricators. Include rated capacities and operating characteristics.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Field quality-control test reports.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.05 QUALITY ASSURANCE**

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

**1.06 RELATED SECTIONS**

- A. Section 22 01 20 - Plumbing General Provisions
- B. Section 40 23 02 - Steel Process Pipe

**PART 2 PRODUCTS****2.01 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black with ends threaded according to ASME B1.20.1.
  1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
  2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
  3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
  4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
  5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
  6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.
- B. Copper Tube: ASTM B88, Type K or L (ASTM B 88M, Type A or B) seamless, drawn-temper, water tube.
  1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.

2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.
  - a. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.02 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
  1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch (3.2-mm) maximum thickness.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- E. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer complying with ASTM F656.

## 2.03 VALVES

- A. Metal Ball, Butterfly, Check, and Gate Valves: Provide all required gate, ball, check valves and outlet connections on air compressor units. Size for maximum flow rating on the compressor unit.
- B. Gate Valves: MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.
- C. Ball Valves: MSS SP-110, Class 150, 400 psi CWP, bronze two-piece body, chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blowout proof stem, lever handle with balancing stops, solder ends with union.
- D. Swing Check Valves: MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

## 2.04 DIELECTRIC FITTINGS

- A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Dielectric Unions: Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

## 2.05 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
  2. End Connections, NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
  3. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
  2. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.
  3. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

**2.06 SPECIALTIES**

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
  - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig (1725-kPa) inlet pressure, unless otherwise indicated.
- C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig (1380-kPa) minimum inlet pressure, unless otherwise indicated.
- D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate.
- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.
- F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

**2.07 QUICK COUPLINGS**

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- B. Through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

**PART 3 EXECUTION****3.01 PIPING APPLICATIONS**

- A. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials as indicated on drawings for each size range:
  - 1. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
- B. Drain Piping: Use one of the following piping materials:
  - 1. NPS 2 (DN 50) and Smaller: Type M (Type C) copper tube; wrought-copper fittings; and brazed or soldered joints.
  - 2. NPS 2 (DN 50) and Smaller: PVC pipe and fittings; and solvent-cemented joints.

**3.02 VALVE APPLICATIONS**

- A. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

**3.03 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss,



expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
  - 1. Use steel companion flange with gasket for connection to steel pipe.
  - 2. Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver.
- K. Install piping to permit valve servicing.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors.
- P. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- R. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- S. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.
- T. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.
- U. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- V. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B828 or CDA's "Copper Tube Handbook."

- W. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- X. Solvent-Cemented Joints for PVC Piping: Clean and dry joining surfaces. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer and join according to ASME B31.9 for solvent-cemented joints and to ASTM D2672.
- Y. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

**3.04 VALVE INSTALLATION**

- A. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- B. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- C. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

**3.05 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

**3.06 FLEXIBLE PIPE CONNECTOR INSTALLATION**

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

**3.07 SPECIALTY INSTALLATION**

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters.
- F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.
- G. Install quick couplings at piping terminals for hose connections.
- H. Install hose assemblies at hose connections.

**3.08 HANGER AND SUPPORT INSTALLATION**

- A. Vertical Piping: MSS Type 8 or 42, clamps.
- B. Individual, Straight, Horizontal Piping Runs:
  - 1. 100 Feet (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.
  - 2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

- C. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- D. Base of Vertical Piping: MSS Type 52, spring hangers.
- E. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
- F. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- G. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1/4 to NPS 1/2 (DN 8 to DN 15): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 3/4 to NPS 1-1/4 (DN 20 to DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
  - 3. NPS 1-1/2 (DN 40): 12 feet (3.7 m) with 3/8-inch (10-mm) rod.
  - 4. NPS 2 (DN 50): 13 feet (4 m) with 3/8-inch (10-mm) rod.
- H. Install supports for vertical, Schedule 40, steel piping every 15 feet (4.6 m).
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
  - 3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
  - 4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
  - 5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
  - 6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
  - 7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
- J. Install supports for vertical copper tubing every 10 feet (3 m).

**3.09 FIELD QUALITY CONTROL**

- A. Perform field tests and inspections.
- B. Tests and Inspections:
  - 1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
  - 2. Repair leaks and retest until no leaks exist.
  - 3. Inspect filters lubricators and pressure regulators for proper operation.

**END OF SECTION**

## SECTION 22 15 19

## PACKAGED COMPRESSED AIR SYSTEM

**PART 1 GENERAL****1.01 SUMMARY**

- A. Furnish and install one (1) dual reciprocating air compressor assembly.
- B. Furnish and install carrier piping systems as specified in Section 22 15 13 between the compressed air equipment specified herein and/or shown on the Drawings and the serviced equipment and devices.
- C. The compressor package shall be supplied by an equipment vendor who is authorized to sell and service the compressor supplied. The vendor shall maintain a service center within a 100-mile radius from the Project site.
- D. Each compressor assembly shall be pre-tested and pre-wired, including an alternator control panel, air dryer, and all other related accessories.
- E. Materials or features not specified herein shall be manufacturer's standard for equipment and shall be included to comprise a complete and reliable system suitable for specified operating conditions.

**1.02 SYSTEM DESCRIPTION**

- A. Function: Air from the air compressors shall be utilized by all the pneumatic operators of various valves throughout the facility, including but not limited to the screen air valves.
- B. Controls: Start-up control shall be provided to turn the compressors on and off automatically. The air dryer will cycle off and on with the compressor. A pressure switch shall start the unit when the receiving tank pressure drops to a cut-in level and shall shut off power to the motor when a pre-determined cut-off pressure is reached.
- C. Alternator Control: Lead and lag status for the dual compressors shall automatically change with each operating cycle when the unit is supplying air from only 1 of the compressors. Additionally, the alternator shall start up the second compressor in the event the air requirement exceeds the capacity of the 1 compressor operating alone in the automatic mode.

**1.03 SUBMITTALS**

- A. Submit shop drawings, and preliminary operation and maintenance manuals for all equipment furnished.
- B. Submit final operation and maintenance instructions before requesting payment for this section of work.

**1.04 WARRANTY**

- A. The manufacturer shall warranty the units against defects in workmanship and materials for a period of 2 years from the date of substantial completion (when unit is placed into normal use, operation and service). The warranty shall be in published form and apply to all similar units. A warranty offered by a representative will not be acceptable in lieu of the manufacturer's warranty. Refer to Section 01 78 37.

**PART 2 PRODUCTS****2.01 COMPRESSOR ASSEMBLIES**

- A. Provide one complete air compressor assembly.
- B. Manufacturers:
  - 1. Quincy QR-25 model FF210.
  - 2. Equivalent by Ingersoll-Rand, or
  - 3. Prior approved equal.
- C. Construction and Features:
  - 1. Style: duplex, tank mounted.
  - 2. Tank orientation: Horizontal.
  - 3. Construction:
    - a. 1 piece cast iron with totally enclosed crankcase.
    - b. Removable, heat-treated, precision-finished disc valves.
    - c. Tapered roller main bearings.
  - 4. Displacement per Compressor: 6.7 cfm at 80 psi FAD and 886 rpm.
  - 5. Cooling: Deep finned, air-cooled cylinders.
  - 6. Lubrication: Pressure lubrication with a positive displacement pump driven by the main crankshaft.
  - 7. Air Control Valve: Valve integrated with oil pressure system to keep each compressor unloaded at start-up until normal operating speed and oil pressure is reached.
  - 8. Low Oil Protection: Compressor shall be unloaded in the event of loss of oil pressure or level.
  - 9. Safety Valve: Excessive pressure in the cylinder shall be vented by a valve. Operation shall be automatic, not requiring resetting upon return to normal pressure.
  - 10. Separator: In-line air/oil separators shall be installed between each of the compressors and the receiving tank.
  - 11. Thermal Protection: Each compressor shall be protected by thermal overload.
- D. Motors
  - 1. Open, drip-proof.
  - 2. V-Belt Assembly:
    - a. Balanced fan flywheels.
    - b. Enclosed belt guards.
    - c. Belt take-ups.
  - 3. Electric power: 2 HP, 460 volt, 3 phase, 60 Hz.
  - 4. Starters equipped with circuit breakers.
- E. Alternator Control Panel:
  - 1. Provide one (1) panel for the Well 8 air compressor installations.
  - 2. Completely wired.
  - 3. Two (2) motor starters
  - 4. Provide a circuit breaker disconnect. This disconnect may be supplied integral to the Alternator Panel, or as a separate, enclosed circuit breaker disconnect mounted directly adjacent to the alternator panel.
  - 5. Fused control panel disconnect.
  - 6. Motor contactors.
  - 7. 3 phase overload relays.
  - 8. Auxiliary contacts.
  - 9. 6-digit run time meter for each compressor
  - 10. NEMA 1 enclosure.
  - 11. Lead/Lag switches that also allow the plant operator to manually select either compressor to repeatedly cycle while the other compressor remains off-line.
- F. Receiving Tank:
  - 1. Size of receiver (gallons): 60-gallon capacity.
  - 2. ASME coded for 200 psig.

3. Automatic drain.
4. Safety valve.
5. Shut-off valve.
6. Pressure regulating valve.
7. Pressure gauge.
8. Low Pressure Alarm Contact.
  - a. Factory set to 30 psi.
  - b. Provide one 120Volt rated, SPDT, dry alarm contact for remote annunciation to SCADA for the compressor low pressure.
9. High Pressure Alarm Contact:
  - a. Factory set to 130 psi.
  - b. Provide one 120Volt rated, SPDT, dry alarm contact for remote annunciation to SCADA for the compressor high pressure.
10. Cut-In Pressure: 80 psig, adjustable w/gauge.
11. Cut-Out Pressure: 100 psig, adjustable w/gauge.
12. Regulator provided on tank. Regulated To: 60 psig, adjustable 40 to 110 psi.
13. Supported off floor by four legs welded to underside.

## 2.02 AIR FILTERS:

- A. Approved Manufacturers:
  1. Domnick Hunter
  2. Prior approved equal.
- B. Pre-Filter
  1. Model A0-0058G, High Efficiency filtration, in-line with auto-drain.
    - a. Particulate removal to 1.0 micron at design air flow.
    - b. Integral pressure gauge to measure pressure drop across filter.
- C. After Filter
  1. Model AA-0058G, High Efficiency oil filtration, in line with auto drain:
    - a. Particulate removal to 0.01 micron at design air flow.
    - b. Integral pressure gauge to measure pressure drop across filter.

## 2.03 DRYERS

- A. Provide one dryer assembly.
- B. Model Zeks HeatSink™ 10 HSE, 115/1/60. cycling dryer, or approved equal.
- C. Refrigerated, cycling air dryer with separate compressed air and refrigerant circuits.
- D. Capacity: 10 cfm at 100 degrees F inlet air, producing air with a pressure dewpoint of 33 degrees F to 38 degrees F.
- E. Automatic, completely wired, 115-volt, 60 Hz, 1 phase.
- F. Automatic drain.
- G. Wall mounted. Provide angle iron wall mounting bracket.
- H. Provide cycling controls.
- I. 1/2-inch FPT pipe connections.
- J. 6-foot power cord.

**2.04 QUICK CONNECTS**

- A. Provide 1/4-inch NPT quick connects at the end of stainless steel air lines where shown on the Drawings and/or specified herein and in Section 23 15 13.
- B. Coordinate with Owner Requirements.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. The compressor assembly shall be installed as shown on the Drawings and in accordance with the manufacturer's recommendations.
- B. All erection and lubrication procedures shall be accomplished according to the manufacturer's recommendation.
- C. Installation of piping and electrical shall conform to the methods and materials specified throughout the Contract Documents.

**3.02 PIPING, MOUNTING AND DRAINS**

- A. All piping shall be provided with sufficient expansion joints, guides, and anchors and be supported so as to preclude the possibility of exerting undue forces and moments on the equipment flanges.
- B. Suitable flexible connectors shall be furnished to isolate the equipment from the piping system.
- C. Contractor shall provide all air piping, hangers, and supports.
- D. Drip funnels and drain piping shall be installed to convey discharge from all automatic drain valves and the air dryer to the nearest floor drain.
- E. Drain piping shall be copper piping sized in accordance with manufacturer's recommendation and installed plumb and parallel to the lines of the building and shall not project into the work path.
- F. Install the filter between the receiving tank and dryer. Refrigerated dryer shall be wall mounted. Provide brackets and support base and anchor as required.

**3.03 ANCHORS**

- A. Contractor shall place all anchors in accordance with certified prints supplied by the equipment supplier.
- B. Anchor bolts shall be 304 stainless steel, adhesive type.

**3.04 POWER AND WIRING**

- A. 460 volt, 3 phase, 60 Hz. power shall be brought to the mounting locations.
- B. 115 volt, 1 phase, 60 Hz. power shall be brought to the mounting locations.
- C. Alternator control panel and disconnect shall be wall mounted adjacent to the compressor units.
- D. Make all final electrical and mechanical connections to complete the air compressor assembly.



**3.05 INSPECTION AND START-UP**

- A. After the Contractor has installed the equipment and the unit is capable of being operated, the equipment manufacturer shall furnish a qualified representative to inspect the equipment and supervise field testing and start-up.
- B. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

**3.06 OPERATOR TRAINING**

- A. Manufacturer's representative shall provide start-up training as specified in Section 01 77 00 to instruct the Owner in operation and maintenance procedures and to certify to the Engineer that the equipment is installed and operated correctly.
- B. Provide minimum of 4 hours of operator training at Owner's convenience after system is operational.

**END OF SECTION**

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## SECTION 33 31 00

## SANITARY SEWER SYSTEMS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Gravity sanitary sewer pipe.
  - 2. Sanitary manholes and appurtenances.
  - 3. Service connections.
  - 4. Service pipe.
  - 5. Riser pipe.
  
- B. Related Sections:
  - 1. Section 31 23 34 - Trenching, Backfilling and Compaction
  - 2. Section 33 01 10 - Tracer Wire
  
- C. Method of Measurement:
  - 1. Sewer Pipe:
    - a. Measure by distance in linear feet.
    - b. Measure along longitudinal axis from manhole centers with no deduction for fittings.
    - c. Measure each pipe size, class, and depth zone separately.
  - 2. Manholes:
    - a. Measure each size and type individually as a unit.
    - b. Unit includes granular foundation, base, precast barrel and cone sections, steps, rings, frame, and cover to a depth of 10 feet.
    - c. Measure depth from lowest invert to top of frame.
  - 3. Excess Manhole Depth:
    - a. Measure by distance in linear feet.
    - b. Measure total distance from lowest invert to top of frame less 10 feet.
  - 4. Manhole Drop Section:
    - a. Measure by distance in linear.
    - b. Measure from upper to lower pipe invert.
    - c. Unit includes base extension, fittings, drop pipe, collar, and differential cost of special lateral pipe material.
  - 5. Manhole Connections:
    - a. Measure connections to an existing manhole as a unit.
    - b. Unit includes cutting and patching of manhole wall and base, and construction of a new invert.
  - 6. Service Connections: Measure fittings of each size and type as a unit.
  - 7. Service Pipe:
    - a. Measure by distance in linear feet of each size.
    - b. Measure horizontally from end of riser fitting to end of pipe.
  - 8. Riser Pipe:
    - a. Measure by distance in linear feet for each size.
    - b. Measure vertically from end of service wye connection fitting to end of riser fitting.
  
- D. Basis of Payment:
  - 1. Payment for acceptable quantities of sanitary sewer items shall be at the Contract Unit Price as listed on the Bid Form.
  - 2. All associated Work items shall be considered incidental.
  - 3. Maintaining sanitary sewer service during construction shall be considered incidental.

**1.02 REFERENCES**

- A. ANSI:
  - 1. A21.4 - Standard for Cement - Mortar Lining for Ductile Iron Pipe and Fittings
  - 2. A21.11 - Standard for Rubber - Gasket Joints for Ductile Iron Pressure Pipe and Fittings
  - 3. A21.51 - Standard for Ductile Iron Pipe Centrifugally Cast
  - 4. A21.53 - Standard for Ductile Iron Compact Fittings, 3-inch through 16-inch
  
- B. ASTM:
  - 1. A48 - Specification for Gray Iron Castings
  - 2. A74 - Specification for Cast Iron Soil Pipe and Fittings
  - 3. C76 - Specification for Reinforced Concrete Pipe
  - 4. C361 - Specification for Reinforced Concrete Low Head Pressure Pipe
  - 5. C425 - Specification for Compression Joints for VCP and Fittings
  - 6. C478 - Specification for Precast Reinforced Concrete Manhole
  - 7. C564 - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
  - 8. D2321 - Recommended Practice for Installation of Flexible Thermo-plastic Sewer Pipe
  - 9. D3034 - Specification for PVC Sewer Pipe and Fittings
  - 10. F477 - Elastomeric Seals for Joining Plastic Pipe
  - 11. F714 - Specification for PE Sewer Pipe and Fittings

**1.03 SUBMITTALS**

- A. Submit Shop Drawings for each manhole.
  
- B. Quality Assurance/Control Submittals:
  - 1. Submit Certificates of Compliance from manufacturers certifying that materials meet reference specifications listed in Article 1.02.
  - 2. Submit record of service connections weekly to Engineer.

**1.04 HANDLING AND DELIVERY OF MATERIALS**

- A. Inspect pipe and materials during unloading process and notify Engineer of cracked, flawed or otherwise defective material.

**1.05 STAKING**

- A. Engineer shall provide necessary staking for all Work under this Section.

**1.06 MAINTAINING SEWER SYSTEM**

- A. Maintain flow in sanitary sewers on continuous basis while construction is underway.
  
- B. Plug sewers with inflatable plug. Provide pumps, portable generators, hoses, and related items appurtenant to the Work.

**PART 2 PRODUCTS****2.01 PIPE AND FITTINGS**

A. Provide the following:

Material	Class	Joint
PVC (within 200' of Well 19 and as shown on drawings)	SDR 18 C-900 <del>SDR 35</del> ASTM D3034 ASTM F477	Elastomeric Gasket <del>Elastomeric Gasket</del> Water Stop Gasket
Cement Lined Ductile Iron	Class 52 ANSI A21.4 ANSI A21.11 ANSI A21.51 ANSI A21.53	Push-On (Pipe) Mechanical (Fittings)
HDPE	SDR 17	Butt-Fusion

B. Provide pipe and fittings of each material type from same manufacturer.

**2.02 MANHOLES**

A. Precast Sections:

1. ASTM C478.
2. Cone: Eccentric.
3. Pipe Joints: Gasketed, watertight.

B. Covers and Frames:

1. ASTM A48:
  - a. Type A: Neenah R1661, self-sealing lid with solid gasket, concealed pick-hole, not non-rocking.
  - b. Adjustment Rings: Concrete, polypropylene, or approved equal, meeting AASHTO M-306, H-25, and HS-25 support requirements

C. Steps:

1. ASTM C497
2. Steel, plastic coated
3. 16inch center on center

D. Manhole Boots:

1. ASTM C923

E. Chimney Seals: Internal/External Seals - Adaptor Inc. or approved equal.

F. **Coat exterior or interior with chemical resistant coating to seal the entire manhole, from the factory or field applied. Submit materials proposed during submittal process.**

**PART 3 EXECUTION****3.01 PREPARATION**

A. Line and Grade: Provide means for accurately transferring line and grade from ground surface stakes to working point in trench.

B. Water Stops: Provide in manholes as required to prevent infiltration into system.

**3.02 CONSTRUCTION REQUIREMENTS**

- A. Pipe Installation:
1. Comply with ASTM D2321 for PVC installation.
  2. Inspect pipe for defects and cracks while suspended before lowering into trench.
  3. Place pipe bell at upstream end of pipe length.
  4. Install pipe from lower to higher invert elevation at a uniform slope between manholes.
  5. Place plug in end of incomplete piping at end of day and when Work stops.
  6. Provide watertight plugs at future connection plugs.
  7. When water is present in trench, seals are to remain in-place while trench is pumped completely dry.
  8. See Section 31 23 33 for pipe foundation and backfill.
  9. Maximum Allowable Deviation From Staked Grade:
    - a. Alignment: 0.30 feet.
    - b. Elevation: 0.02 percent.
- B. Manhole Installation:
1. Place precast manhole base on compacted granular subgrade.
  2. Locate steps within 1 inch of vertical alignment and within 1 inch of required vertical spacing.
  3. Provide monolithic base for drop manholes.
  4. Maximum Allowable Deviation From Staked Grade:
    - a. Alignment: 0.30 feet.
    - b. Elevation: 0.03 feet.

**3.03 FIELD QUALITY CONTROL**

- A. Remove all dirt and foreign material from pipe interior prior to testing.
- B. Gravity Sewer Pipe:
1. Pipe Diameter 27 Inches and Smaller: Air test.
  2. Pipe Diameter Larger Than 27 Inches: Infiltration test.
- C. Perform the following tests upon completion of sewer construction and prior to any external plumbing connections:
1. Infiltration Test:
    - a. Manholes shall be watertight, with no leakage permitted.
    - b. Place 90-degree V-notch weirs in locations directed by Engineer to measure leakage in sewer lines.
    - c. Allowable leakage rate shall be 100 gallons/day/inch diameter/mile of sewer between any adjacent manholes.
    - d. Provide corrective measures for lines exceeding the allowable leakage rate.
  2. Air Test:
    - a. Place inflatable sewer stoppers in manhole at each end of reach to be tested.
    - b. Connect 1 end of an air hose to plug used for air inlet.
    - c. Connect other end of hose to portable air control equipment.
    - d. This equipment consists of valves and pressure gages used to control the rate air flows to the test section and to monitor air pressure inside the pipe.
    - e. Connect an air hose between compressor (or other source of compressed air) and control equipment.
    - f. Add air to pipe section. Monitor air pressure so pressure inside pipe does not exceed 5.0 psig.
    - g. When pressure reaches 4.0 psig, stop air supply so internal pressure is maintained for 2 minutes.
    - h. These 2 minutes allow time for air temperature to come to equilibrium with the pipe walls.
    - i. During this time check plugs with soap solution to detect any plug leakage. If plugs are found to leak, bleed off air, tighten plugs, and begin again by supplying air.
    - j. After temperature has been allowed to stabilize for 2 minutes, disconnect air supply and allow pressure to decrease to 3.5 psig.
    - k. At 3.5 psig, start stopwatch to determine time required for pressure to drop to 2.5 psig.

- l. Provide corrective measures for any line not meeting requirements.
  - m. Test results are usually better if sewer pipe walls are damp at time of testing.
  - n. Time shall be equal to or greater than the allowable time shown in table at end of this Section.
3. Deflection Test:
- a. Perform on PVC pipe at least 30 days after trench backfill has been placed.
  - b. Perform test by pulling a mandrel through each line between manholes without aid of mechanical pulling devices.
  - c. Mandrel diameter: Minimum 95 percent of the base inside diameter of the pipe as follows:

<b>Nominal Size (in.)</b>	<b>Base I.D.</b>	<b>5% Deflection Mandrel</b>
4	3.874	3.68
6	5.742	5.46
8	7.665	7.28
10	9.563	9.08
12	11.360	10.79
15	13.897	13.20
18	16.975	16.13
21	20.004	19.01
24	22.481	21.36
27	25.326	24.06
30	28.639	27.21
33	32.224	30.61
36	35.808	34.02
42	40.401	38.38
48	46.094	43.79

- d. The line will be considered acceptable if mandrel can progress through line without binding.
- e. Provide corrective measures for lines not meeting these requirements.



**Time Required for a 0.5 PSIG Pressure Drop for Size and Length of Pipe Indicated**

1 Pipe Diameter (inches)	2 Minimum Time (minutes:seconds)	3 Length for Minimum Time (feet)	4 Time for Longer Length (seconds)	Specified Minimum for Length (L) Shown (minutes:seconds)								
				100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet	
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	9:53
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50	14:16
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	22:16
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	32:04
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	43:38
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17	57:00
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	72:07
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	89:01
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57	107:43
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23	128:12
42	19:74	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04	174:31
48	22:67	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09	227:56

**END OF SECTION**

## SECTION 40 23 20

## PROCESS PIPING VALVES AND OPERATORS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Process piping valves.
  - 2. Process piping valve accessories.
  - 3. Process piping valve installation.
- B. Related Sections:
  - 1. Section 40 23 00 - Process Piping General Provisions
  - 2. Section 40 23 10 - Process Water and Waste Piping
  - 3. Section 40 92 40 - Process Valve Actuators

## 1.02 SUBMITTALS

- A. Submit in accordance with Section 01 33 00 - Submittal Procedures the following items:
  - 1. Product data
  - 2. Dimensions
  - 3. Manufacturer recommendations for installation

## PART 2 PRODUCTS

## 2.01 MATERIAL

- A. Size, joint type, and body material of process valves shall correspond to the size, joint type, and material of adjacent piping, unless otherwise stated on Contract Drawings and specifications.

## 2.02 EQUIPMENT

- A. Gate Valves (3-inch or larger):
  - 1. Valves shall be resilient seated gate valves conforming to the latest revision of AWWA standard C-509.
  - 2. Valves shall be non-rising stem, opening by turning stem left and provided with a handwheel, unless otherwise shown or specified, and the word "open" and an arrow cast in the metal to indicate direction to open.
  - 3. The wedge shall be cast iron completely encapsulated, except for guide and stem nut areas, with polyurethane rubber.
  - 4. The polyurethane sealing rubber shall be permanently bonded to the cast iron wedge to meet ASTM tests for rubber to metal bond ASTM D429.
  - 5. Stem shall be cast bronze with integral collars in full compliance with AWWA standards. The stem stuffing box shall be the O-ring seal type with two O-rings located above the thrust collar. The two O-rings shall be replaceable with valve fully open and subjected to full rated working pressure.
  - 6. Provide two low torque thrust bearings located above and below the stem collar. The stem nut shall be independent of wedge and shall be made of solid bronze.
  - 7. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area.
  - 8. The body and bonnet shall be coated on the interior and exterior with fusion bonded epoxy.
  - 9. Each valve shall have manufacturer's name, size, pressure rating, and year in which manufactured cast on the body.
  - 10. Prior to shipment from factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure.
  - 11. Approved Manufacturers: Clow, American, Mueller, M&H, or approved equal.

- B. Butterfly Valves:
1. Butterfly valves 3-inch through 30-inch shall have flanged ends and meet or exceed the requirements of AWWA C504 Class 150B and MSS SP-67.
  2. Valve body shall be ASTM A126 Class B cast iron.
  3. Disc:
    - a. 3-inch to 20-inch valves: The disc shall be a lens-shaped design to afford minimal pressure drop and line turbulence. Materials of construction shall be:
      - 1) 3-inch to 6-inch: ASTM A351 gr. CF8N stainless steel disc
      - 2) 8-inch to 20-inch: ASTM A126, Class B cast iron disc with a stainless steel Type 316 edge
    - b. 24-inch and larger valves: All valve discs shall be constructed of ductile iron ASTM A536 with a stainless steel seating edge. The disc shall not have any hollow chambers that can entrap water. All surfaces shall be visually inspected and measurable to assure all structural members are at full disc strength. Disc and shaft connection shall be made with stainless steel pins.
  4. Valve stem shall be 304 stainless steel and shall be supported on upper and lower nylon bearings.
  5. Seat and stem seals shall be acrylonitrile-butadiene.
  6. The seat shall be compression molded in the body and shall conform to ASTM D429 test standards.
  7. All process butterfly valves throughout the treatment facility shall be by the same manufacturer. Contractor shall coordinate with fabricated gravity filter supplier.
  8. Operators
    - a. Hand levers shall be provided for all 4-inch and smaller butterfly valves. Hand levers shall be directly connected to the shaft, parallel to the disc, and shall rotate 90° from full open to tight close. Unless otherwise noted, levers shall include a locking device to assure positive disc position in the open, closed and at least 8 intermediate positions around the quadrant of rotation.
    - b. Handwheel operators shall be provided for all 6-inch and larger butterfly valves. Valves with centerlines more than 6 feet above the floor shall be equipped with chain wheels and chains. Handwheel operators (geared actuators) shall be furnished with a 2-inch AWWA nut, cast iron handwheel. Handwheels shall have a maximum diameter of 12 inches. The operator shall be capable of throttling the valve in any position and holding this position under all operating conditions. The unit shall be of the worm screw or traveling nut type, totally enclosed, operating in a lubricant. Exterior position indication shall be provided. Maximum handwheel or chainwheel pull shall be 80 pounds at the rim.
    - c. Handwheel floorstand operators and torque tubes shall be provided for valves as shown on the drawings. The floorstand operators shall include position indicators and geared actuators. Henry Pratt Diviner Handwheel Floorstand or equivalent by Dezurik.
    - d. All butterfly valves shall be provided with position indicators.
    - e. Provide electric or pneumatic actuators where shown on the drawings in accordance with the Pneumatic Actuators article of this section or Section 40 92 40.
    - f. Provide torque tubes, extension bonnets, u-joints, steady bearings, wall brackets, and extension shafts as shown on the drawings and required for a complete functioning system. Items shall be manufactured by Henry Pratt Company or equivalent by Dezurik.
    - g. Provide extended necks with wall brackets where shown on the Drawings. The extended neck shall be made of an interior 6-inch diameter schedule 80 steel pipe, with the exterior being made of 8-inch schedule 40 pipe. Extended neck braces shall consist of drill-in type anchor bolts with galvanized or stainless steel pipe supports.
  9. All process butterfly valves throughout the treatment facility shall be by the same manufacturer.
    - a. In-plant butterfly valves shall be Pratt 2FII by Plant and Flanged, Pratt Triton XR-70 by Plant and Flanged, or DeZurik BAW. No substitutes.
    - b. Buried butterfly valves shall be Pratt Groundhog or DeZurik BAW.
    - c. Buried valves shall have an AWWA nut and valve box.
- C. Swing Check Valves (Air Cushioned)
1. The swing check valve shall be constructed with heavy cast iron or cast steel body with a bronze or stainless steel seat ring, a non-corrosive shaft for attachment of weight and lever, and

- complete non-corrosive trim cushion chamber. Body shall have minimum 175 psi pressure rating and shall be provided with ANSI standard 125-pound flanges.
2. Valve shall absolutely prevent the return of water, soil, or gas back through the valve when the inlet pressure decreases below the deliver pressure. The valve must be tight seating, and must be cushioned in operation. The seat ring must be renewable.
  3. The cushion chamber shall be of bronze construction and the shock absorption by air. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The cushion chamber shall be arranged that the closing will be adjustable to meet the service requirements.
  4. The valve disc shall be convex and of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.
  5. All material and workmanship shall be first class throughout and the purchaser reserves the right to inspect this valve before shipment.
  6. Air cushioned swing check valves shall be Golden Anderson Figure No. 250-D, or APCO Series 250.
- D. Plastic Ball Valves:
1. Furnish true union manually operated ball valves in PVC construction.
  2. Valves shall have lever operators unless otherwise noted.
  3. Ball valves as manufactured by Chemtrol, or equal, and which meet these specifications will be accepted.
- E. Plug Valves:
1. In-Plant Plug Valves - General:
    - a. Valves on sludge, sewage and water shall be non-lubricated eccentric type with resilient-faced plugs. Valves shall be operated by nuts, or cast iron handwheels or chainwheels as indicated on the Drawings. Operators whose center line is 6'-6" or higher above the operating floor, shall be equipped with galvanized shrouded pocket handwheels and sherardized chains. Bolt-on chainwheels for mounting on standard handwheels will not be acceptable. Handwheels and chainwheels shall have a maximum diameter of 12 inches. Maximum handwheel or chainwheel pull shall be 80 pounds at the rim.
    - b. All valves, except those indicated on the Drawings, shall be equipped with gear actuators. All bearing surfaces shall be enclosed, suitable for running in oil or grease with seals provided on all shafts to prevent entry of dirt and water into the actuator. Actuator shall clearly indicate valve position and an adjustable stop shall be provided to set closing. Valve packing adjustment on non-submerged valves having adjustable packing shall be accessible without removing the actuator from the valve. Construction of actuator housing shall be cast iron or semi-steel. All exposed nuts, bolts, and washers shall be zinc plated.
    - c. Provide pneumatic actuators where shown on the Drawings in accordance with Section 40 92 40.
    - d. Certified copies of proof-of-design test reports shall be furnished in accordance with AWWA C504, Section 5.2.
- F. Air Release and Air Release/Vacuum Breaker Valves
1. General:
    - a. Air release valves, air/vacuum release valves and combination air valves shall conform to AWWA C512 and be manufactured by APCO Valve Corporation; Val-Matic; Crispin; or equal.
    - b. Body, cover and baffle shall be cast or ductile iron. Fasteners, internal linkage, internal parts, floats, and float guide shall be stainless steel. Elastomers shall be Buna-N.
    - c. All valves shall be furnished with an inlet shut-off ball valve. Discharge lines shall extend down to 18 inches above the floor.
    - d. Valves on sewage lines shall be equipped with backflushing attachments consisting of a 1-inch blow-off valve, shut-off valve, and quick disconnect coupling and a minimum of 6 feet of back-flushing hose.
    - e. Add a pipe saddle if valve and pipe tap size required for flow condition are too large to allow adequate thread depth.

- f. Venting rate and size for all valves shall be within the manufacturer's recommendations.
- 2. Air Release Valves
  - a. Air release valves shall allow entrained air in pipelines to escape through an air release orifice. After entrained air escapes, the valve orifice shall close by a needle mounted upon a compound lever mechanism actuated by a float. Air release shall remain closed until more air accumulates and the opening cycle is repeated.
  - b. Water valves shall be APCO Series 200, Val-Matic (Model 38, 45, or 50), or equal.
  - c. Sewage air release valves shall be APCO Series 400 or equal.
- 3. Air Release/Vacuum Breaker Valves:
  - a. Design valve to exhaust air from well pump column piping upon pump startup, and allow air to re-enter column piping when pump shuts down.
  - b. Water valves shall be APCO Series 140, Val-Matic (Model 100, 101, or 102).
  - c. Equip with adjustable throttling device to regulate flow of air escaping during pump startup.
- 4. Combination Air Valves:
  - a. Combination air valves shall be a single housing style that combines the operating features of an air release/vacuum breaker valve, as well as an air release valve when the system is under pressure.
  - b. Water valve shall be APCO Model 143C, 145C, 147C, 149C, 150C, or 151C, Val-Matic Series 200, or equal.
- 5. Valve Sizes:

Type	Location	Size	Comments
Air/vacuum release	Filter room See Keynote 12 on Section 1P301 in Plan Set	1"	Installed in pipe tap in blind flange on run of 4x4x4 tee
Air/vacuum release	After well discharge See Keynote 4 on 01-P101 in Plan Set	4"	Tap 12" pipe for 4" air/vac valve
Air release	High Service Pumps (3 locations)	3/4"	Three high service pumps, see Section 43 21 13

- G. Sample Taps - Water Only:
  - 1. Sample cocks shall be mounted where shown on Drawings.
  - 2. Sample taps for water shall be constructed of brass. They shall be suitable for bacteriological testing and have no internal threads, screens, aerators, external threads at the discharge, or other small areas that would encourage bacterial growth.
  - 3. The main body shall be a one-piece, angle pattern globe valve with an integral MPT pipe connection, a hex nut, and a smooth-nose discharge. The seat seal shall be rubber. The operating knob shall be round, at least 1.25-inch diameter, replaceable, and constructed of plastic or metal.
    - a. For pressures <80 psi, provide 1/2-inch chrome-plated smooth-end sampling cock, Zurn Z-80401, or equal.
    - b. For pressures >80 psi, provide 1/2-inch satin brass smooth-end sample cock, Conbraco 26-314, or equal.
- H. Valve Tags & Equipment Tags:
  - 1. Valve Tags: All new valves and major process equipment shall be tagged. CONTRACTOR shall furnish and install on valves, engraved 2 1/2-inch by 2 1/2-inch plastic laminated tags, Seton "Setonply Series M4550-H," or equal.
  - 2. Nomenclature for tagging (letters and numbers) will be provided by ENGINEER.
  - 3. Colors will be selected by OWNER.
  - 4. CONTRACTOR shall affix tags to valves with Brady 3809, or equal, stainless steel wire and Brady 38090, or equal, zinc wire clamps.

5. Tags shall be engraved plastic. Plastic shall be three colored layers. Engraving shall reveal the inner, contrasting color. Lettering shall be 1/2-inch-high minimum. Unless otherwise noted, use black tags with white lettering.

**I. Pipe Labels**

1. Manufacturers: Marking Systems, Inc., Seton Name Plate Company, W.H. Brady Company, or equal.
2. Pipe markers shall conform to ANSI A13.1. Arrow markers must have same ANSI background colors as their companion pipe markers or be incorporated into the pipe identification marker.
3. Plastic Pipe Markers: Factory-fabricated, flexible, semirigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
4. Pipe markers and arrow markers also shall be provided for all piping systems.
5. Use Seton Setmark type SNA or Brady Snap-on type identification for all piping systems, up through 6 inches.
6. For piping systems larger than 6 inches, use Seton or Brady strap-on markers, or similar, by Marking Services, Inc. Self-adhesive labels are not acceptable. Provide lettering in accordance with information below:

<b>Outside Pipe Dia. (Including Covering)</b>	<b>Minimum Length of Label Field (Inch)</b>	<b>Minimum Height of Letters (Inch)</b>
3/4 inch to 1-1/4 inch	8	1/2
1-1/2 inch to 2 inch	8	3/4
2-1/2 inch to 6 inch	12	1-1/4
8 inch to 10 inch	24	2-1/2
Over 12 inches	32	3-1/2

**J. Rubber Flapper Swing Check Valves:**

1. Manufacturer: APCO Series 100.
2. Provide on discharge of sludge and recycle pumps as shown on Drawings. Provide two 4-inch valves and two 6-inch valves.
3. Materials and Construction:
  - a. Cast Iron Body.
  - b. Tight Sealing.
  - c. O-ring Seating.
  - d. Buna-N Coated Steel Disc.
  - e. Manual Back Flushing Hold-Open Device.

**K. Surge Relief Valves:**

1. Manufacturer: Cla-Val Model 50-01
2. Replace Golden Anderson 12-inch by 14-inch surge relief valve with a Cla-Val 10-inch surge relief valve.
3. Cla-Val 10-inch valve shall be provided with a pipe train adapter on the outlet side to increase to a 14-inch pipe size. Furnish any and all necessary adaptors or pipe fitting materials to connect to the existing facility piping.
4. Function:
  - a. The valve shall maintain a constant upstream pressure by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close.
5. Main Valve:
  - a. The valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.
6. Main Valve Body:
  - a. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. Ductile Iron is standard and other materials shall be



## ADDENDUM 5

available. No fabrication or welding shall be used in the manufacturing process. Total shipping weight, in all respects, shall be equal to or greater than the Hytrol 100-01/100-20 body.

- b. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted, and no V-type or slotted type disc guides shall be used.
  - c. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.
  - d. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.
  - e. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6 inches and smaller size valves shall be threaded into the cover and body. Valve seat in 8 inches and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To ensure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.
  - f. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one-year warranty.
  - g. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4-inch through 24-inch sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damage.
7. Material Specification:
- a. Valve Size: 10-inch.
  - b. Main Valve Body and Cover: Ductile Iron.
  - c. Main Valve Trim: stainless steel.
  - d. End Detail: 150# flanged, globe pattern.
  - e. Temperature Range: normal.
  - f. Rubber Material: Buna-n.
  - g. Coating: fusion bonded epoxy inside.
  - h. Desired Options: X105LCW close limit switch.

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Inspect all material and equipment as it is received to determine damage and/or missing parts. Repair or replace damaged items in accordance with the manufacturer's instructions.

**3.02 INSTALLATION AND TESTING**

- A. Each item or system shall be furnished complete and installed as shown on the drawings and in accordance with the manufacturer's recommendations, instructions and directions. The complete installation shall function properly and reflect a high work quality.
- B. Refer to related sections of this specification for additional installation and testing requirements and information. Tests shall be conducted after all valves are installed.

**3.03 PAINTING**

- A. The exterior of all valves, operators, and accessories, unless otherwise described, shall be painted as specified under Section 09 91 00. Valves shall be painted to match the color of the adjacent piping.

**3.04 OPERATOR TRAINING**

- A. Provide minimum of 2 hours of operator training, for each type of actuator function (electric or pneumatic) included in the Project. Schedule training at Owner's convenience, after system is operational.

**3.05 VALVE SCHEDULE**

- A. Reference Sheet ~~01-P901-01~~ **P101** in the Drawings for the Project Valve Schedule.
- B. The Valve Schedule has been included for the purposes of conveying information regarding operator requirements for some of the **process** valves to be installed as part of this project. **The Valve Table/Schedule does not include the valves and actuators provided with the Filters Equipment skids, those are to be provided by the Filter Equipment manufacturer and are not listed on the Valve Schedule. Other minor valves are not listed, and the Valve Schedule is NOT intended to list every valve on the project.**

**END OF SECTION**



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## SECTION 40 23 30

## PROCESS PIPING SPECIALTIES

**PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Miscellaneous process piping items.
- B. Related Sections:
  - 1. Section 40 23 00 - Process Piping General Provisions
  - 2. Section 40 23 10 - Process Water and Waste Piping

**1.02 REFERENCES**

- A. ASTM:
  - 1. C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
  - 2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005
  - 3. E96 - Standard Test Methods for Water Vapor Transmission of Materials; 2000
- B. NFPA:
  - 1. 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; 2006
- C. UL:
  - 1. 723 - Standard for Test for Surface Burning Characteristics of Building Materials, 2003

**1.03 SUBMITTALS**

- A. Submit Product Data which includes the following for each item furnished:
  - 1. Manufacturer and model.
  - 2. Component materials.
  - 3. Dimensions.
- B. Seal Installation Through Fire-rated Wall, Roof, or Floor:
  - 1. Provide Engineer and Code Official with 2 copies each of proposed firestop system for each pipe penetration.
  - 2. System information shall include:
    - a. UL system numbers.
    - b. F and T ratings.
    - c. Detailed drawing.
    - d. Manufacturer name.
    - e. Installation procedure.
    - f. List of components.

**PART 2 PRODUCTS****2.01 EXPANSION JOINTS**

- A. EPDM or Teflon single-filled arch spool type.
- B. Full face steel flanges.

- C. Temperature Range: 40 to 100 degrees F.
- D. Design for UV exposure.
- E. Maximum Working Pressure: 125 psi.
- F. Furnish tie rods, limiter sleeves, and retaining brackets where indicated on Drawings.
- G. Acceptable Manufacturers:
  1. Proco Products, Inc.
  2. Red Valve Co., Inc.
  3. Approved equals.

## 2.02 PRESSURE GAGES AND COCKS

- A. Pressure Gage:
  1. Size: 4-1/2 inch dial.
  2. Range: ~~0-160 psi, unless shown on Drawings.~~ Will be specified during the shop drawing submittals, and will vary by location of the gage on the piping.
  3. Graduation: ~~2-psi.~~ will be specified during the shop drawing submittals, graduation will vary by gage.
  4. Accuracy: 1/2 percent.
  5. Movement: Heavy-duty stainless steel.
  6. Case: Fiberglass Reinforced Polypropylene.
  7. Mounting: Direct (stem).
  8. Connection: 1/4-inch NPT, bottom.
  9. Glycerin - filled.
  10. Manufacturer: Weksler AY04 or approved equal.
- B. Isolation Cock:
  1. Ball valve.
  2. Suitable to 200 psi.
  3. 1/4-inch NPT male and female connections.

## 2.03 PIPE COUPLINGS

- A. Sleeve type.
- B. Furnish to match pipe being coupled.
  1. Size.
  2. Material.
  3. Pressure.
  4. Service of pipe.
- C. Acceptable Manufacturers/Models:
  1. Dresser, Style 38.
  2. Smith Blair, Type 411.
  3. Approved equal.

## 2.04 FLANGED ADAPTERS

- A. Furnish to match the pipe being connected:
  1. Size.
  2. Material.
  3. Pressure.
  4. Service of pipe.

- B. Acceptable Manufacturers/Models:
  - 1. EBBA Iron Series 2100 Megaflange.
  - 2. Dresser, Style 127.
  - 3. Smith Blair, Type 911.
  - 4. Approved equal.

## 2.05 PIPE SLEEVES

- A. Material: Steel Pipe.
  - 1. Furnish zinc-coated steel pipe in the following installations:
    - a. Masonry walls and floor.
    - b. Fire-rated gypboard partitions.
    - c. Masonry or steel deck roofs.
  - 2. Furnish zinc-coated sheet steel in the following installation:
    - a. Non fire-rated gypboard partitions.
- B. Size:
  - 1. Minimum: 2 nominal pipe sizes larger than respective pipe.
- C. Acceptable Manufacturers/Models:
  - 1. American Cast Iron Pipe, Model A-01770.
  - 2. Approved equal.

## 2.06 SEALS

- A. Furnish positive hydrostatic pipe link seal.
  - 1. Sealing Element: Synthetic rubber material expanded by tightening of zinc galvanized plate carbon bolts.
- B. Acceptable Manufacturers:
  - 1. Thunderline Corp.
  - 2. Approved equal.

## 2.07 WALL PIPES

- A. Material: Ductile iron.
- B. Size and End Connections: Match adjacent pipe.
- C. Furnish with welded or integrally-cast waterstop collar.
- D. Acceptable Manufacturers:
  - 1. Clow Pipe.
  - 2. American Cast Iron Pipe.
  - 3. Approved equal.

## 2.08 FLOATING SUCTION STRAINERS AND HOSES

- A. Contractor shall furnish and install a floating suction strainer in each backwash reclaim tank.
  - 1. Dimensions of tank are shown in contract drawings.
- B. Approved Manufacturer:
  - 1. Megator Corporation Dolphin Floating Suction Strainer.
  - 2. Pureflow Filtration Division Floating Decanter System.
- C. Provide two 4-inch suction strainer with a minimum capacity of 300 gallons per minute for installation in the rehabilitated lagoon.

- D. Materials and construction:
  1. Stainless steel construction.
  2. Floating chamber of polyurethane foam.
  3. Freely turning tube to prevent hose from twisting.
  4. Eye for providing mooring or for attaching weight.
  5. Anti-vortex plates.
- E. Non-floating hose:
  1. Approved Manufacturer: Dayco U-10 non-floating hose or Engineer approved equal.
  2. Floating suction strainer manufacturer shall provide 20-feet of hose.
  3. Cut hose to fit during installation.
  4. Hose shall connect to 4-inch DIP flange.
- F. Contractor shall fabricate a cable system to keep floating suction from drifting and to allow vertical movement of flexible hose.

## 2.09 SPRAY NOZZLES

- A. Approved Manufacturers:
  1. Spraying Systems Company, Wheaton Illinois.
  2. Or Engineer approved equal.
- B. Materials and Construction.
- C. Uni-Let Model 1/4 TT4060 brass nozzles:
  1. Qty: As called for in the Drawings.
- D. Uni-Let Model 1/4 TT1560 brass nozzles:
  1. Qty: As called for in the Drawings.
- E. Provide the following nozzles assembly for each nozzle listed above:
  1. Nozzle body.
  2. Spray tip.
  3. Tip retainer.
  4. No. 5540 swivel assembly.
- F. In general, installation of the spray wash nozzles is as described:
  1. The head end of the tanks, are the shallow ends and the hopper end is the deep end of the tanks.
  2. Along the head ends of the tanks, four (4) 1560 type nozzles are to be installed in the center of the tanks along the springline (equator) of the spray wash pipe.
  3. Four (4) 1560 type are to be installed on the bottom of the head end pipe, two near the pipe center pointing in toward the center of the head end of the tank, and two installed near the corner 90's oriented in the same manner.
  4. Along the long sides of the tanks, 1560 type nozzles are to be installed along the bottom of the spray wash pipes at 6 feet - 0 inch spacing starting 6 inches away from the head end 90's.
  5. Along the spring-lines of the long side pipes, 4060 type nozzles are to be installed where spacing is greater than 6 inches on center.
  6. Use 1560 type nozzles at the head of the tanks where nozzles are spaced at 6 inches on center.
  7. The spring-line nozzle spacing notes are identified per one side of the tank and apply equally to all long sides.

## 2.10 STATIC MIXER

- A. Furnish and install two (2) static mixers for blending chemical with the water.
  1. Number of units: 2.
  2. Location: See sheet GP 002 and 01-P101 Keynote 9 and 32.
    - a. One (1) in the raw water pipe.
    - b. One (1) in the filtered water pipe.
  3. Pipeline Diameter: 12-inch.

4. Flow Rate: 2,300 gpm.
5. Chemical Feed Taps on each mixer:
  - a. Qty: 3.
  - b. Sizes on raw water:
    - 1) one (1) 1.5-inch for chlorine feed.
    - 2) one (1) 0.75-inch spare.
    - 3) one (1) 0.75-inch spare.
  - c. Sizes on finished water:
    - 1) one (1) 0.75-inch for fluoride feed.
    - 2) one (1) 0.75-inch spare.
    - 3) one (1) 0.75-inch spare.
6. Elements: One set of six (6) vane style elements designed to suit the mixer with a length to diameter ratio of 1D (Element length = 1 nominal mixer diameter).
7. Maximum Pressure Drop: 0.4 psi.
8. Overall Length of Unit: 12-inch.
9. Construction: 316SS.
10. Manufacturer
  - a. Statiflo DSM Series (1D Version).
  - b. Or equal pre-approved by Engineer.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. General:
  1. Install all items in accordance with manufacturer's recommendations.
  2. Install items only where indicated on the Drawings.
  3. Installation at other location only with prior approved by the Engineer.
- B. Pipe Sleeves:
  1. Sleeve each pipe individually.
  2. Floor Installation: Extend sleeve 2 inches above finished floor.
  3. Roof Installation:
    - a. Extend sleeve from 4 inches below to 12 inches above roof deck.
    - b. Furnish with welded attachment brackets.
    - c. Furnish with weather skirt for each sleeve.
  4. Provide continuously welded waterstop collar on sleeves set in masonry or concrete.
- C. Seals:
  1. Installation through fire-rated wall, floor, or roof.
  2. Seal annular space between piping and sleeve with approved brand fire barrier caulk or putty.

**END OF SECTION**

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## SECTION 40 92 40

## PROCESS VALVE ACTUATORS

**PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Pneumatic power-actuating devices for process valves.
- B. Related Sections:
  - 1. Section 09 91 50 - Shop Painting
  - 2. Section 40 23 04 - Process Piping Valves and Operators

**1.02 REFERENCES**

- A. AWWA:
  - 1. C540 - Power-Actuating Devices for Valves and Sluice Gates
  - 2. C541-08 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates
- B. Materials:
  - 1. Alloy cast iron: ASTM A436.
  - 2. Aluminum: ASTM B179, Alloy 356.1.
  - 3. Aluminum: ASTM B85.
  - 4. Brass or Bronze: ASTM B154, less than 7 percent zinc.
  - 5. Cast iron: ASTM A126.
  - 6. Cast steel: ASTM A216.
  - 7. Carbon steel: ASTM A108.
  - 8. Ductile iron: ASTM A536.
  - 9. Electroless-nickel plate: ASTM B733.
  - 10. Fabricated steel: ASTM A36, ASTM A516.
  - 11. Nickel-copper alloy: ASTM B127, ASTM B164.
  - 12. Stainless steel: ASTM Z276, type 304 or better.
  - 13. Zinc alloy: ASTM B-240.

**1.03 DESIGN REQUIREMENTS**

- A. Features:
  - 1. The following shall be completed without removal of the actuator covers:
    - a. Setting of the torque levels and position limits.
    - b. Configuration of the indication contacts.
- B. Sizing:
  - 1. Size actuator to ensure valve closure at the differential pressure at each location.
  - 2. Verify differential pressures at each location prior to ordering.
  - 3. Coordinate with valve manufacturer to ensure proper sizing for each valve model and size.
- C. Commissioning Tools:
  - 1. Provide with each actuator.
  - 2. Shall not form an integral part of the actuator.
  - 3. Shall meet enclosure protection and certification levels of the actuator.
  - 4. Shall be removable for secure storage/authorized release.
  - 5. Ensure protection of configured actuator settings by a means independent of access to the commissioning tool.



**1.04 PERFORMANCE REQUIREMENTS**

- A. Environmental:
  1. Suitable for indoor and outdoor use.
  2. Capable of functioning in an ambient temperature range of 32 degrees F to 100 degrees F.
  3. Capable of functioning in relative humidity up to 100 percent.
- B. Operating Speed:
  1. Provide valve opening and close at 12 inches per minute.
  2. Capable of adjustment.
- C. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10 percent below normal.

**1.05 SUBMITTALS**

- A. Product Data: Submit Product Data for each type of actuator provided.
- B. Shop Drawings: Submit scaled Shop Drawings for each size and type of actuator provided.
- C. Quality Assurance:
  1. A list of actuators to be provided for each application which includes:
    - a. Torque capabilities.
    - b. Operating torques.
      - 1) Seating.
      - 2) Unseating.
  2. Certificates of performance testing.
- D. Close-out:
  1. System start-up reports.
  2. Operation and maintenance manuals.

**PART 2 PRODUCTS****2.01 CYLINDER-TYPE PNEUMATIC ACTUATORS**

- A. Supply cylinder-type pneumatic actuators capable of open/close operation and/or modulating operation where specified or indicated in the Drawings. Provide actuators for valves as indicated on the Valve Schedule in the Drawings. [on Sheet GP4.](#)
- B. Where specified or indicated in the Drawings, valves are to be supplied with enclosed pneumatic cylinder operators and shall have a disc maximum stop limit and position indicator.
- C. Shaft seals and seats shall be suitable for continuous operation up to 180 degrees F.
- D. Cylinder shall be double-acting with stop nuts provided to position cylinder. The air compressor for operation of the pneumatic system shall be provided as specified in Section 22 15 ~~00~~ 13.
- E. Pneumatic cylinder operators shall be rigid-mounted without swivel movement during valve operation. A manual operator shall also be provided, which is able to function in the event of loss of air pressure in the pneumatic operators.
- F. Conform to the requirements of AWWA C540 and C541.
- G. Materials
  1. Cylinder Head and End Caps: Ductile iron.
  2. Piston Rod: chrome plated stainless steel.

3. Epoxy coat interior surfaces.
- H. Valve supplier shall determine torque requirement of butterfly valve for selection of actuator based on a flow rate ~~of 400 gpm~~ in each pipe where a valve is located.
- I. Air Supply:
  1. Normal operation: 80 psi air supply.
  2. Pressure rating: 150 psi.
- J. Solenoid Valves:
  1. 4-way solenoid valves for 120V, 60 Hz, single-phase, AC power supply shall be furnished for each operator.
  2. Solenoid valves shall be NEMA 4X and shall be mounted on the operator or in a solenoid cabinet.
  3. Rate of opening and closing adjustment shall be provided for all solenoid valves.
- K. Limit Switches:
  1. All pneumatic actuators shall be furnished with limit switches as follows:
    - a. Mechanical function, quick set cam actuated limit switches.
    - b. Two (2) SPDT contacts rated 10A continuous at 120VAC.
    - c. NEMA 4X enclosure, epoxy coated, cast aluminum, explosion proof, watertight, corrosion proof enclosure.
    - d. One 3/4-inch and one 1/2-inch conduit entries.
    - e. Indicator Lights
      - 1) Red: valve closed.
      - 2) Green: valve open.
    - f. Limit switches shall be by the same manufacturer as the actuators.
- L. Fail Positions:
  1. Valves shall fail to either a fully open or fully closed position in the case of air pressure loss.
  2. Loss of power shall cause valve to return to normal open/close fail position.
  3. See Valve Schedule for the fail position of each valve.

## 2.02 MANUFACTURERS

- A. The pneumatic actuators shall match the valve manufacturers and be of the following:
  1. Henry Pratt Company: Pratt MDT actuator and Dura-Cyl® cylinder.
  2. DeZurik approved equal.

## 2.03 ACCESSORIES

- A. Supply each actuator with a start-up kit.
  1. Content:
    - a. Installation manual.
    - b. Electrical wiring diagram.
    - c. Cover seals to make good any site losses during the commissioning period.
    - d. Supply sufficient tools to enable set up and adjustment during valve/ actuator installation, testing, and commissioning.
- B. Furnish and install an air line moisture, dirt and oil extractor unit at process air supply source (Coordinate with Section 22 15 00)

## 2.04 FABRICATION

- A. Cylinder actuators for valves 3-inch through 8-inch shall be of the scotch yoke type. Valve sizes 10-inch and larger shall be supplied with a compound link and lever arrangement designed to minimize water hammer by providing characterized opening and closing. The concept of characterized closure is to reduce the flow area quickly to 20 percent open in the first half of the actuator stroke, and then slow down the disc travel to close off the last 20 percent of the flow area.

- B. All wetted parts of the cylinder shall be nonmetallic, except the cylinder rod which shall be chromium plated stainless steel. The rod seals shall be of the nonadjustable, wear compensating type. A rod wiper for removing deposits inside the cylinder shall be provided in addition to an external dirt wiper. Cylinder actuator can be supplied with an optional manual override.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install equipment and accessories in accordance with manufacturer's instructions.

**3.02 FIELD QUALITY CONTROL**

- A. The manufacturer or duly appointed representative shall provide the following services:
  - 1. After installation and prior to start-up:
    - a. Inspect all installations.
    - b. Perform necessary adjustments and modifications.
  - 2. During start-up operations: Supervise initial start-up.
  - 3. Post start-up:
    - a. Make all final adjustments.
    - b. Provide minimum of 8 hours of operation and maintenance training for Owner's personnel.

**END OF SECTION**

## SECTION 43 21 13

## HORIZONTAL CENTRIFUGAL SPLIT CASE PUMPS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section includes the furnishing and installation of horizontal split case centrifugal pumps, motor, mounting bases, anchor bolts, and appurtenances necessary for satisfactory operation.
- B. Pump shall be installed in lay length provided location of the existing booster pumps.
- C. Related Sections:
  - 1. Section 09 91 50 - Shop Painting
  - 2. Section 26 29 24 - Variable Frequency Drives

## 1.02 PERFORMANCE REQUIREMENTS

- A. Liquid Temperature Range: 40-70 degrees F.
- B. Meet or exceed the operating condition requirements listed at the end of this section.
- C. NSF 61/372 compliant.
- D. Performance Requirements.
  - 1. Design basis Small Booster Pump (QTY1):
    - a. Fairbanks Morse 1824 single-stage, split-case, horizontal centrifugal pump.
    - b. Impeller: 444A329.
    - c. Suction: 6-inch.
    - d. Discharge: 5-inch.
    - e. Speed: 1800 rpm.
  - 2. Design Condition:
    - a. Full speed (1775 rpm).
    - b. Provide 1,400 gpm against a total dynamic head of 175 feet.
    - c. Minimum efficiency at this speed = 77 percent.
    - d. Minimum shut-off head: 210 feet.
    - e. Runout flow: 1,950 gpm at 120 feet.
  - 3. Design Basis Large Booster Pumps (Qty 2)
    - a. Fairbanks Nijhuis 1823 single-stage, split case, horizontal centrifugal pump.
    - b. Impeller: 444R330.
    - c. Suction: 8-inch.
    - d. Discharge: 6-inch.
    - e. Speed: 1800 rpm.
  - 4. Design Condition:
    - a. Full speed on (1775 rpm).
    - b. Provide 2,100 gpm against a total dynamic head of 175 feet.
    - c. Minimum efficiency at this speed = 81 percent.
    - d. Minimum shut-off head: 215 feet.
    - e. Runout flow: 2900 gpm at 105 feet.

## 1.03 SUBMITTALS

- A. Product Data:
  - 1. Preliminary characteristic performance curves.
  - 2. List of pump components and materials.

- B. Shop Drawings:
  1. Pump schematic.
  2. Component sizes and dimensions.
  3. Field measurements of existing piping conditions including available space between pipe flanges to remain.
- C. Test Reports: Certified factory H.I. performance test results for pumps to be provided prior to shipping.
- D. Manufacturer's Operation and Maintenance Instructions.
- E. Close-out:
  1. Performance test results from installed units.
  2. Provide within 7 days of field testing.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fairbanks Morse, Kansas City, KS
- B. Approved equal.

**2.02 EQUIPMENT**

- A. High Service Pump Schedule
  1. High Service Pump No. 1: HSP-1.
  2. High Service Pump No. 2: HSP-2.
  3. High Service Pump No. 3: HSP-3.
- B. General Requirements:
  1. Split case centrifugal pump with shaft in the horizontal orientation.
  2. Quantity: three (3).
  3. NSF 61 and NSF 372 Listed to comply with the Reduction of Lead in Drinking Water Act.
  4. Maximum Speed: 1800 rpm.
  5. Rated Motor Horsepower: (QTY 1) Small Booster:100 HP; (QTY 2) Large Boosters: 125 HP.
  6. Power Supply: 480V, 3-phase, 60 Hz.
  7. Acceptable Pumps:
    - a. Fairbanks Morse Pump
      - 1) Size: 5-inch 1824 (QTY 1); and 6-inch 1823 (QTY 2).
      - 2) Maximum pressure: 250 psig.
    - b. Other pumps are acceptable only if they meet all the requirements of this specification and with prior approval by Engineer.
- C. Materials
  1. Casing: Cast iron (ASTM A48.)
  2. Impeller (for use with chlorinated water above 2 PPM): Alpha Nickel Aluminum Bronze or 316 Stainless Steel.
  3. Shaft Sleeve: 316 stainless steel.
  4. Shaft: Steel AISI C1045.
  5. Casing Wear Ring: 416 stainless steel.
  6. Impeller Wear Ring: 316 stainless steel.
  7. Base Plate: Structural steel or cast iron.
- D. All pumps furnished under this section shall be provided by the same manufacturer.

**2.03 COMPONENTS**

- A. Casing:
  - 1. Horizontal split cast design.
  - 2. Flange Connections: ANSI 125 pound rated.
  - 3. Tapped and plugged holes for priming and draining. Furnish and install a 0.75-inch air release valve installed in a provided tap in the top of the volute of each casing, to facilitate air removal from the water column. See Section 40 23 20 for Air Release Valve requirements. Install with isolation ball valve. Route discharge per the air release detail and provide stainless steel screen.
  - 4. Provide for removal of the rotating element without disconnecting the suction or discharge piping.
  - 5. Furnish lower half of casting with cored passageways from the high-pressure area of the volute to each seal box for positive lubrication without the use of external flushing lines.
  - 6. Integrally cast bearing arms with lower half of casing to ensure positive bearing alignment.
  - 7. Bolt-on bearing arms are not acceptable.
  
- B. Impeller:
  - 1. Enclosed type, vacuum cast in one piece.
  - 2. Dynamically balanced.
  - 3. Key to shaft.
  - 4. Exterior Finish: Turned.
  - 5. Interior Finish: Finished smooth, free of burrs, trimmings, and irregularities.
  
- C. Shaft Sleeves:
  - 1. Seal sleeve to impeller hub by means of an O-ring.
  - 2. Positively drive sleeve to the keyway.
  - 3. Fasten the sleeve to the shaft by means that the manufacturer recommends.
  
- D. Shaft Seal: Mechanical, Type 21.
  
- E. Shaft:
  - 1. One piece, finished and polished on all sections.
  - 2. Length: Shortest practicable distance between bearings to minimize deflection and vibration.
  - 3. Maximum Allowable Deflection: 0.002 inches at any point on the pump operating curve.
  
- F. Casing Wearing Ring:
  - 1. Radial type.
  - 2. Press fit into casing.
  
- G. Bearings:
  - 1. Regreasable lubrication ball type.
  - 2. Average Life: 100,000 hours.
  - 3. Radial Loads: Provide single row inboard bearings.
  - 4. Thrust Loads: Provide double row outboard bearings.
  - 5. Mount bearings in moisture and dust proof machined housing.
  - 6. Housing:
    - a. Registered fits to ensure alignment.
    - b. Pinned, to prevent rotation.
    - c. Bolt to bearing arms.
  - 7. Supply each housing with grease fitting and plugged relief port.
  
- H. Coupling:
  - 1. Provide flexible coupling to connect pump and motor shaft.
  - 2. All metal type with flexible rubber insert.
  - 3. Enclose entire rotating coupling element by means of a coupling guard.
  
- I. Base Plate:
  - 1. Mount pump and motor on:
    - a. Groutable steel base plate.
    - b. Steel drip rim base plate.

2. Incorporate integral drip channels on each side.
3. Provide NPT connection and plug for each channel.
4. Capable of supporting pump and motor without the use of additional supports or members.

J. Nameplate:

1. Mount permanent nameplate in a prominent location on the pump.
2. Include the following information:
  - a. Manufacturer's name.
  - b. Serial number.
  - c. Pump design characteristics.

K. Motors:

1. NEMA configuration.
2. Premium efficiency.
3. Totally enclosed, fan-cooled.
4. Design for normal starting torque and low starting current.
5. Size: Sufficient to operate pump from shutoff head to open discharge without operating in the motor service factor.
6. Horsepower Rating: Sufficient to operate pump at any point on the head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor.
7. Class F thermostat, one per phase.
8. Motor shall be inverter duty, 10:1 turndown (6-60 Hz), and meeting NEMA MG1 Part 31.
9. Manufacturers:
  - a. US Motors.
  - b. Marathon.
  - c. WEG.
  - d. Baldor.

- L. Shop Coatings: Coat pump and base in accordance with Section 09 91 50.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install pump in accordance with manufacturer's recommendations.

### 3.02 FIELD QUALITY CONTROL

A. Field Testing:

1. Conduct test of the pumping equipment in the presence of the Engineer.
2. Testing Period: One hour minimum, or longer as may be required to determine compliance with the specifications.
3. Provide all power, gages, measurement devices, and other apparatus required for the testing.
4. Remove all testing equipment upon completion of testing.
5. Provide copies of all test data and results to Owner and Engineer.
6. Resulting pump capacities shall be within 5 percent of the previously supplied certified curves.
7. Replace or rework pumping equipment or components which fails to meet the specified requirements.

- B. Manufacturer's Field Services: Check pumps and motors for alignment (using laser alignment device) after installation and prior to field testing.

### 3.03 DISINFECTION

- A. Disinfect all water contact surfaces prior to placement in service.

- B. Disinfectant: 200 ppm chlorine solution or dusting chlorine compound per AWWA C654.

**3.04 DEMONSTRATION**

- A. Provide minimum of 4 hours of operator training after pumps are in service.

**END OF SECTION**



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SECTION 43 21 30

NON-CLOG SUBMERSIBLE PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish, install, and test submersible pumping units and accessories as indicated on the Drawings and as specified herein. Pumps shall be solids handling type.
- B. Four (4) submersible pumps will be installed throughout the facility.
  - 1. Two (2) Reclaim Tank - Backwash Waste
  - 2. Two (2) Reclaim Tank - Reclaim Water
- C. Related Sections
  - 1. Section 09 91 50 - Shop Painting
  - 2. Section 09 97 21 - Coating Systems for Water Facilities
  - 3. Section 26 05 05 - Basic Electrical Materials and Methods
  - 4. Section 26 24 19 - Motor Control
  - 5. Section 40 23 00 - Process Piping General Provisions
  - 6. Section 40 90 00 - Instrumentation and Control for Process System
  - 7. Section 44 44 00 - Process Equipment General Provisions

1.02 DEFINITIONS

- A. AFBMA: Anti-friction Bearing Manufacturers Association
- B. AISI: American Iron and Steel Institute
- C. ASTM: American Society for Testing and Materials
- D. FM: Factory Mutual
- E. HI: Hydraulic Institute Standards
- F. NEC: National Electrical Code
- G. NEMA: National Electrical Manufacturers Association
- H. NFPA: National Fire Protection Association

1.03 DESIGN REQUIREMENTS

- A. As presented below:

	Backwash Waste Pumps	Reclaim Water Pumps
Quantity	2	2
Design Condition (GPM)	100	220
TDH (total dynamic head)	25 feet	<del>38</del> 60 feet
Minimum Motor HP (nominal)	3	<del>7.5</del> 15
Minimum Pump Efficiency (%)	30%	30%
Maximum Motor RPM	1,750	1,750
Discharge Size (inches)	4	4 *see note

**\*Table Note: Reclaim water pump discharge (two each) shall have a transition from the 4-inch pump discharge to the 6" reclaim pipe size. Contractor shall furnish fittings, reducers, or appurtenances to transition to the piping size from the discharge size of the pump.**

- ~~B. The pumps shall meet the following future conditions:~~
  - ~~1. Backwash pumps shall produce 100 gpm at 24 ft Total Dynamic Head (TDH). Reclaim Water pumps shall produce 220 gpm at 35 feet TDH.~~
  - ~~2. Motor horsepower shall be 3 HP, minimum for Backwash pumps and 7.5 HP minimum for Reclaim water pumps. Motor speed shall be 1750rpm, maximum. The motor shall have a minimum service factor of 1.2.~~

**1.04 SUBMITTALS**

- A. Shop Drawings in accordance with Section 01 33 00 and include the following:
  - 1. Name of manufacturer.
  - 2. Size and model number.
  - 3. Performance curves.
  - 4. Certified performance curves.
  - 5. Detailed specifications and dimensions.
  - 6. Motor specifications.
  - 7. Installation guide.
  - 8. Printed warranty.
- B. Operating and Maintenance Data in accordance with Section 01 78 23.
- C. Certified Installation Inspection and Start-up Services.

**1.05 QUALITY ASSURANCE**

- A. The pumps shall be heavy duty, electric submersible centrifugal non-clog units non-overloading throughout the entire operating range of the pump suitable for continuous operation at full nameplate load while the motor is completely or totally submerged.

**1.06 WARRANTY**

- A. The pump manufacturer shall warrant the pumps, motors, and guide removal systems to the Owner against defects in materials and workmanship for a period of five years or 10,000 hours of operation under normal use and service.
- B. The pump manufacturer's warranty shall be in printed form and previously published as the manufacturer's standard warranty for all similar units manufactured. A copy of the warranty shall be provided to the Owner at system start-up.

**PART 2 PRODUCTS**

**2.01 MANUFACTURER/MODEL:**

A.

	<b>Backwash Waste Pumps</b>	<b>Reclaim Water Pumps</b>
Hydromatic	S4NRC	S4SD

B. Pre-approved Equivalent.

**2.02 COMPONENTS****A. Pumps:**

1. Each pump shall be of the sealed submersible type as manufactured by Hydromatic and be capable of pumping municipal sewage with spherical solids up to three inches in diameter. The castings (cord cap, motor housing, bearing housing, seal plate) shall be of high quality, ASTM A48, Class 30, gray cast iron. The pump discharge shall be fitted with 4-inch standard ANSI 125# flange, faced and drilled. All external mating parts shall be machined and Buna N rubber O-ring sealed on a beveled edge. Flat faces and gaskets shall not be acceptable. All fasteners exposed to the pump's liquids shall be of 300 series stainless steel.
2. The pump volute shall be ASTM Class 30 and shall consist of a centerline discharge on piece design. The passages are to be large enough to pass the same size solid as the impeller.
3. Impeller shall be either ASTM Class 30 cast iron or ASTM Class 65 ductile iron. The impeller mounting is to be a slip fit onto a tapered shaft and a drive key. The impeller shall be attached to the shaft by a stainless steel fastener and impeller washer. The impeller is to be balanced to ISO1944 standards and is to be a two vane, or multi-vane, recessed vortex impeller.
4. An upper radial bearing and lower thrust bearing shall be required in the motor. The upper bearing shall be heavy-duty radial single row ball bearing while the lower bearing shall be a double row heavy duty angular contact ball bearing of the thrust limiting design. Minimum of 50,000 hours of B10 bearing life for radial and thrust bearings while operating across entire hydraulic operating range of the pump. Bearings shall be lubricated for life from the factory and will be accomplished through the non-toxic, low viscous, dielectric oil in the frame
5. The pump/motor shaft shall be 0.002" at BEP. The rotor and stator in the motor housing shall be separated and protected from the pumped liquid by an oil-filled seal housing incorporating two (2) John Crane seals. Both lower and upper seals shall be a Carbon-Ceramic faces and be replaceable without disassembly of the seal chamber and without the use of special tools. Seals shall be mounted in tandem. The seal housing/chamber shall be equipped with two moisture sensing probes installed between the seals. Mechanical seals must be locally available and nonproprietary.

**B. Pump Shaft:**

1. Provide an AISI type 416 stainless steel pump shafts.
2. The pump and motor shafts shall be the same unit.
3. Couplings are not acceptable.

**C. Impeller:**

1. The impellers shall be gray cast iron, dynamically balanced, 2 vane, non-clogging design having a long through let without acute turns.
2. Impeller shall be keyed to the shaft. Securing of the impeller shall be accomplished via a special taper action, locking device.
3. A wear ring system shall be used to provide efficient sealing between the volute and suction side of the impeller. Each pump shall be equipped with a nitrile rubber coated steel or bronze ring insert that is drive fitted to the volute inlet.

**D. Motor:**

1. The pump motors shall be a squirrel-cage, induction, shell type design, housed in a NEMA B type, oil-filled watertight chamber. The stator windings and leads shall be insulated with moisture resistant Class H insulation rated for 155°C (311°F). The stator will be dipped and baked three times in Class F varnish and heat-shrunk fitted into the stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty, capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum.
2. Thermal sensors used to monitor stator temperatures shall be imbedded in the stator lead coils to monitor the temperature of each phase winding and set to open at 125 degrees C (260°F). These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and connected to the control panel to stop the pump and signal an alarm condition. A float leakage sensor shall be provided to detect water in the stator chamber. These shall work in conjunction with the controls to signal an alarm condition. The submersible pump manufacturer shall provide the over/temp/moisture sensor control and monitoring unit to the Owner.

3. The junction chamber shall be hermetically sealed from the motor by an elastomer O-ring seal.
4. Motors shall be 480 volt, 3-phase, 60 Hz.
5. The pump shaft shall rotate on two bearings rated for B10 life of 40,000 hours at anticipated axial and radial loading. Motor bearings shall be permanently greased. The upper bearing shall be a single roller bearing and the lower bearing shall be a two-row angular contact bearing.
6. Provide two totally independent mechanical shaft seal assemblies, installed in tandem, each with its own independent spring system acting in a common direction. The seals shall operate in an oil reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower seals shall be tungsten-carbide both faces. The upper seal unit shall contain one positively driven rotating carbon ring installed in an oil-filled chamber with positive anti-leak sealing drain and inspection plug. Each seal interface shall be held in contact by its own spring system. The seals shall not require routine maintenance or adjustment or depend on direction of rotation for sealing. Seals shall be capable of being easily inspected and replaced. Shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units will not be acceptable.
7. Motor shall be oil filled; seal chambers shall contain only ecologically safe paraffin base oil.
8. Pump shall be capable of running dry while out of pumped liquid for extended periods without damage.
9. The power cable shall be sized according to the NEC and ICEA standards. It shall be of sufficient length to reach the junction box without splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The cable entry to the motor shall consist of a single cylindrical elastomer grommet flanked by washers. The motor and cable shall be capable to continuous submergence under water without loss of watertight integrity to a depth of 65 feet.
10. **Recycle pump Motors** shall be designed for operation with a variable frequency drive. Motors shall be rated inverter duty per the requirements of Division 26

### **2.03 ACCESSORIES**

- A. Power Cable:
  1. The pumps shall be supplied with power cable sized according to NEC standards and shall be of sufficient length to reach the motor terminal housing without the need of any splices.
  2. The outer jacket shall be oil resistant chloroprene rubber.
- B. Discharge Connection Base
  1. Sealing of the pumping unit to the permanently mounted discharge connection shall be accomplished by a simple downward motion of the pump guided to and wedged tightly against the discharge connection. Final connection shall insure zero leakage between pump and discharge connection flange.
  2. No portion of the pumping unit shall bear directly on the sump floor or pedestal.
- C. Pump Removal System:
  1. Provide a pump removal system consisting of galvanized pipes to guide the pumping unit to the discharge connection elbow where shown on the Drawings. Provide anchorage for guides to concrete slab.
  2. Provide 316 stainless steel lifting cable of sufficient length to permit raising the pump for inspection and removal.
  3. The working load of the lifting system shall be 50 percent greater than the pump unit weight.
- D. Cable Holder and Safety Hooks:
  1. Furnish PVC coated cable holders to hold power cables and float switches.
  2. Provide stainless steel safety chain hooks for lifting chain or cable.

## **PART 3 EXECUTION**

### **3.01 DELIVERY OF EQUIPMENT**

- A. Delivery of equipment shall be coordinated with the requirements of the Contractor.

**3.02 INSTALLATION**

- A. Install equipment in accordance with manufacturer's recommendations and as shown on Drawings.
- B. Equipment manufacturer to furnish necessary anchor bolts, nuts, washers, gaskets and anchor bolt templates.
- C. Install all anchors in accordance with certified prints supplied by equipment manufacturer.

**3.03 DISINFECTION**

- A. After all the potable water process equipment, piping, and filters are completed, they shall be disinfected in accordance with the Virginia Department of Health Standards
- B. Perform disinfection of all process piping and equipment in accordance with the following:
  - 1. AWWA C651.
  - 2. AWWA C653.
- C. Hold chlorine solution in pipe for a minimum of 24 hours.
  - 1. Initial Dosage: 50 ppm minimum.
  - 2. Residual Dosage After Hold Period: 10 ppm minimum.
- D. Operate all valves and other equipment during disinfection to ensure complete coverage.
- E. Flush system with potable water within 24 hours after disinfection is completed.
- F. After flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
  - 1. Take sample sets from various representative areas of the piping.
  - 2. Minimum Samples Required: 2.
- G. Perform coliform and chlorine residual tests on each sample.
- H. Rechlorinate if any samples test positive for coliform.
- I. After satisfactory test results are achieved, the piping may be connected to the potable water system.

**3.04 SYSTEM AND EQUIPMENT STARTUP**

- A. Conform to the requirements of Section 01 75 00.
- B. The manufacturer or single source supplier of equipment included in each section shall inspect the completed installation; make all necessary adjustments, corrections, or modifications prior to start-up. See Section 44 44 00.
- C. Provide written certification that check-out services have been completed and 1 week notice prior to start-up and demonstration.
- D. Place various items of equipment into operation, along with related piping and control systems, at times acceptable to Owner. After satisfactory start-up of these systems and their related equipment, they will remain in continuous or intermittent operation as required by the Owner.
- E. All equipment and accessories shall be adjusted and calibrated prior to any start-up and any equipment placed into temporary operation prior to Final Completion of the total Project shall be readjusted and/or recalibrated as necessary.
- F. Contractor shall supervise, control, and be responsible for operation and maintenance of new equipment and/or systems during start up.
- G. No system start-ups will be held on holidays, Fridays, or the day before a holiday.

**3.05 DEMONSTRATION AND TRAINING**

- A. Provide factory trained serviceman to instruct the Owner's personnel in the proper operation and maintenance of the equipment and certify to the Engineer that system is installed and operating properly, refer to Sections 01 75 00 and 40 05 00.
- B. Following completion of successful equipment start-up, the Contractor shall arrange for a factory representative and installer of each operating piece of equipment and other work requiring regular or continuing maintenance, to meet at Site with Owner's personnel to provide necessary basic instruction in proper operation and maintenance of entire work. Where installers are not experienced in required procedures, include instruction by manufacturer's representatives.
- C. For each piece of operating equipment, the factory representative and installer shall provide two separate training sessions to the Owner's operations and maintenance staff. The two training sessions shall be separated in time by at least 1 week (7 days) and shall be arranged to meet the schedules of the Owner's operations and maintenance staff.
- D. Each training session shall be inclusive of a minimum 4 hours on-site instructional time. All travel time and costs necessary to perform each training session shall be considered as additional and incidental to four hours of on-site instructional training time.
- E. The training session time shall be separate and distinct from the time spent on equipment start-up.
- F. Contractor shall coordinate the schedule for each training session a minimum of 2 weeks (14 days) ahead of schedule.
- G. All final copies of the Operation & Maintenance manuals for each piece of operating equipment shall be delivered to the Engineer a minimum of 1 week (7 days) prior to scheduling the initial training session.
- H. At a minimum, each training session shall include the following:
  - 1. Utilize operation and maintenance manuals as basis for instructions.
  - 2. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
  - 3. Include a detailed review of the following items:
    - a. Maintenance manuals.
    - b. Record documents.
    - c. Spare parts and materials.
    - d. Tools.
    - e. Lubricants.
    - f. Fuels.
    - g. Identification systems.
    - h. Control sequences.
    - i. Hazards.
    - j. Cleaning.
    - k. Warranties.
    - l. Maintenance agreements and similar continuing commitments.
  - 4. Manufacturer's representative shall demonstrate the following procedures to Owner's personnel prior to date of final inspection:
    - a. Startup.
    - b. Shutdown.
    - c. Emergency operations.
    - d. Noise and vibration adjustments.
    - e. Safety procedures.
    - f. Economy and efficiency adjustments.
    - g. Effective energy utilization.
    - h. Troubleshooting.
    - i. Maintenance.

- I. Prepare and insert additional data in operations and maintenance manuals if need for additional data becomes apparent during instructions.

**END OF SECTION**



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## SECTION 44 44 39

## FLUORIDE FEED EQUIPMENT

**PART 1 GENERAL****1.01 SUMMARY**

- A. Furnish and install complete chemical feed system for injecting fluoride.
- B. Work Included: This section includes furnishing, installing, and placing into successful operation one complete fluoridation system. Fluoridation system shall include a tank with scale, and peristaltic positive displacement metering pump. The equipment and appurtenances shall be furnished by the same supplier.

**1.02 REFERENCES**

- A. WDNR NR 811.
- B. Recommended Standards for Water Works "Ten State Standards", 1997 Edition.
- C. NSF - NSF International, Ann Arbor, MI.

**1.03 SUBMITTALS**

- A. Refer to Section 01 33 00.
- B. Shop Drawings: Indicate system schematics, equipment locations, details, and control schematics.
- C. Product Data: Submit manufacturer's Product Data indicating chemical treatment methods, chemicals, equipment, and installation and maintenance instructions.
- D. Submit reports in accordance with Section 01 75 00 and include:
  - 1. Report indicating start-up of treatment system is completed and operating properly.
  - 2. Report indicating analysis of system water after treatment.
  - 3. Report indicating analysis of fluoride residuals measured immediately after each injecting point and post filtration.
- E. Operation and Maintenance Manuals: Prior to start-up, furnish operation and maintenance manuals in accordance with Section 01 78 23.

**1.04 DEFINITIONS**

- A. PVC: Polyvinyl chloride.
- B. NPT: National pipe thread.

**1.05 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide equipment by one supplier.
- B. Regulatory Requirements: Materials and equipment provided in this Section shall comply with the recommended practices and standards of NSF International.

**1.06 WARRANTY**

- A. All equipment, unless otherwise stated, shall be warranted by the manufacturer for 1 year from the date of start-up.

**PART 2 PRODUCTS****2.01 GENERAL**

- A. Use common components to the greatest degree possible to simplify spare parts inventory and service.

**2.02 TANKS**

- A. Manufacturers:
1. Snyder
  2. Polyprocessing
  3. Assmann
- B. Description:
1. Number: 1.
  2. Volume: 160-gallon.
  3. Diameter: 35-inch maximum.
  4. Material: Polyethylene, complying with NSF requirements and compatible with intended chemical.
  5. Construction: 1-piece seamless construction with ultraviolet inhibitor capable of storing liquid chemicals up to a specific gravity of 1.90.
  6. Calibration: 1-gallon increments.
  7. Closed top with threaded lid.
  8. Tank and all wetted parts shall be chemically compatible with fluoride solution.
- C. Equip as follows:
1. 7-inch threaded cap
  2. 1-1/2-inch PVC dip leg with suction tubing and strainer inside tank.
  3. 1-1/2-inch NPT bulkhead on top of tank for metering pump pressure relief return. Install with lines through bulkhead with grommet to prevent vapor escape.
  4. 2-inch NPT bulkhead for venting the tank.
  5. Metering pump pressure relief return(s).
  6. Secondary containment basin
    - a. Min. capacity shall be sized to fully contain the volume of the feed tank.
    - b. Manufactured of high-density polyethylene materials. Materials shall be compatible the materials being stored in the tank.

**2.03 METERING SCALE**

- A. Provide one 2,000-pound capacity Force Flow Model 40-DR20LP chem-scale, or equal, complete with Force Flow Model Solo G2 indicator, or equal. Indicator shall be 115-volt, single-phase and shall provide a 4-20 mA output proportional to the weight on the scale. Verify scale size is sufficient with the 160-gallon solution tank and containment basin provided. Scale and Solo G2 indicator shall be capable of displaying in 0.1-pound increments to determine daily chemical usage.

**2.04 FEED PUMPS**

- A. Manufacturer
1. Feed pump units shall be ~~Blue-White Industries~~, shall be Flex-Flo Pro-Series M-1 manufactured in the U.S.A. by ~~Blue-White Industries Model AIN10V-6T-0 (16.0 GPD)~~, or equal.

## B. Description:

1. Provide one (1) ~~Blue-White Industries, Model AIN10V-6T-0 (16.0 GPD)~~, chemical feed pumps, ~~or equal~~. Pumps shall be capable of producing 0.67 gph at 100 psi.
2. ~~Metering pump shall be a positive displacement, peristaltic-type tubing pump with a variable speed motor, non-spring-loaded roller assembly located in the pump head, integral tube failure detection system, and flexible tubing with attached connection fittings.~~
  - a. ~~There shall be no valves, diaphragms, springs, or dynamic seals in the fluid path. Process fluid shall contact the pump tubing assembly and connection fittings only.~~
  - b. ~~Pump shall be capable of self-priming at the rated maximum pressure.~~
  - c. ~~Pump shall be capable of running dry without damage.~~
  - d. ~~Pump shall provide suction lift of up to 30 feet of water.~~
3. ~~Metering pump head shall be a single, unbroken track with a clear removable cover.~~
  - a. ~~Hastelloy C-276 tube failure detection sensors shall be wholly located in the pump head. Tube failure detection system shall not trigger with water contact. Float switch-type switches shall not be used.~~
  - b. ~~Squeeze rollers shall be directly coupled to a one-piece Valox 420 SEO rotor. Three polymeric squeeze rollers located 120 degrees apart shall be provided. The roller diameters and occlusion gap shall be factory set to provide the optimum tubing compression; field adjustment shall not be required.~~
  - c. ~~Rotor assembly shall be installed on a D-shaped, chrome-plated motor shaft and removable without tools.~~
  - d. ~~For tubing installation and removal, rotor assembly shall be rotated by the motor drive. Hand cranking of the rotor assembly shall not be required.~~
  - e. ~~Pump head and tubing compression surface shall be corrosion resistant Valox 420 SEO thermoplastic.~~
  - f. ~~The pump head cover shall be clear, acrylic thermoplastic with an integral bearing fitted to support the overhung load on the motor shaft.~~
  - g. ~~Cover shall be positively secured to the pump head using three thumb screws. Tools shall not be required to remove the pump head cover.~~
4. ~~Pump tube shall be assembled to connection fittings of PVDF material.~~
  - a. ~~Connection fittings shall be permanently clamped to the tubing with stainless steel clamps. To prevent tubing misalignment and ensure accuracy, fittings shall insert into keyed slots located in the pump head and secured in place by the pump head cover. Fitting shall not rotate when installed.~~
  - b. ~~Connection fittings shall accept 1/4 inch i.d. by 3/8 inch o.d. flexible tubing.~~
5. ~~Pump drive assembly shall be factory installed and totally enclosed in a NEMA 3R, outdoor-rated enclosure.~~
  - a. ~~Motor shall be DC gear motor-rated for continuous-duty with overload protection. Variable speed motor shall be adjustable from 5 percent to 100% in 1 percent increments. Motor shall continuously rotate over the entire adjustment range; start/stop pulsation shall not be permitted.~~
  - b. ~~Enclosure material shall be injection molded Valox 420 SEO with NEMA 3R rating. Provide slots in the enclosure base for shelf mounting and two slots in the rear panel for wall mounting. Stainless steel mounting hardware shall be provided.~~
  - c. ~~Provide 6-foot-length power supply cord with NEMA 5/15 U.S. 115 Vac attachment plug.~~
  - d. ~~A wiring compartment shall be provided for connection of input/output signal wires, and alarm output load. Conduit hubs, liquid-tight connectors, connector through holes and tapped holes shall be sized in U.S. inches.~~
6. ~~Control circuitry:~~
  - a. ~~Provide front panel user touchpad controls for stop/start, configuration menu access and navigation, operating mode selection, auto-priming, and service timer reset.~~
  - b. ~~The front panel touchpad and LCD display shall be wholly enclosed by a clear acrylic door secured by two slide clamps.~~
  - c. ~~Provide LCD display for menu-driven configuration settings, pump output value, service alerts, and tube failure detection (TFD) system, alarms status, remote input signal values, tubing life timer value.~~
  - d. ~~Provide for manual control of pump output volume via manual speed percentage operating mode.~~

## ADDENDUM 5

- ~~e. Provide for remote control of pump output volume via 4-20 mA, 0 to 10 Vdc, and 0 to 1000 Hz pulse operating modes.~~
- ~~f. Provide one contact closure alarm output rated at 1A-250 Vac, 0.8A-30 Vdc. Alarm output shall close in the event that the Tube Failure Detection (TFD) system senses a tube failure.~~
- ~~g. The pump shall be listed to UL standard 778 Motor Operated Pump, CSA Standard C22.2-Process Control Equipment, and NSF/ANSI Standard 61-Drinking Water System Components-Health Effects.~~
- ~~h. Tube Failure Detection (TFD) system sensors shall be wholly located in the pump head. TFD system will stop the pump within 3 seconds of leak detection. To prevent false alarms because of rain, washdown, condensation, etc., tube failure detection system shall not trigger with water contact.~~
- ~~7. Spare Parts: Provide two replacement hoses.~~
- 2. The chemical metering pumps shall be positive displacement, peristaltic type tubing pumps with a variable speed motor, non-spring-loaded roller assembly located in the pump head, integral tube failure detection system, and flexible tubing with attached connection fittings.
  - a. Process fluid shall contact the pump tubing assembly and connection fittings only.
  - b. Capable of self-priming at the rated maximum pressure.
  - c. Capable of running dry without damage.
  - d. Suction lift shall be 30 feet of water.
  - e. Pump shall have a one-year manufacturer's warranty that includes chemical damage to the pump head and roller assembly caused by a ruptured pump tube assembly.
- 3. Tube Assemblies:
  - a. Pump tube shall be of a material suitable for continuous contact with hydro-fluorosilicic acid (19.1%).
  - b. Connection fittings shall accept 1/4-inch ID by 3/8-inch OD flexible tubing.
  - c. Connection fittings shall be permanently clamped to the tubing with stainless steel clamps. To prevent tubing misalignment and ensure accuracy, fittings shall insert into keyed slots located in the pump head and secured in place by the pump head cover. Fitting shall not rotate when installed.
- 4. Control Circuitry:
  - a. Provide front panel user touchpad controls for stop/start, configuration menu access and navigation, operating mode selection, auto priming, and service timer reset.
  - b. Provide LCD display for menu driven configuration settings, pump output value, service alerts, tube failure detection (TFD) system alarms status, remote input signal values, tubing life timer value.
  - c. Provide for manual control of pump output volume via manual speed percentage operating mode.
  - d. Provide for remote control of pump output volume via 4-20mA operating mode.
  - e. Pump will be wired to operate in series with the activation of the well pump motor and will be flow paced off of the finished water flow meter.
  - f. Secondary feeder control will be provided by a confirmation of the flow switch on the well pump discharge piping.
  - g. Provide one contact closure alarm output rated at 1A-250VAC, 0.8A-30VDC. Alarm output shall close in the event that the Tube Failure Detection (TFD) system is triggered.
- 5. Drive System:
  - a. The pumps shall have a capacity to pump fluoride at the rate specified above into a water flow rate at 10 to 80 psi. The pumps shall be designed to operate at no lower than 20 percent of the feed range at the minimum capacity.
  - b. 10,000:1 turndown.
  - c. The pumps shall be 120 VAC, single phase, 60 Hz. A wiring compartment shall be provided for connection of input/output signal wires, and alarm output load. Conduit hubs, liquid-tight connectors, connector through holes and tapped holes shall be sized in U.S. inches.
- 6. Tube Failure Detection (TFD) system sensors shall be wholly located in the pumphead. TFD system will stop the pump within three seconds of leak detection. To prevent false alarms due to rain, wash-down, condensation, etc., tube failure detection system shall not trigger with water contact. Process fluid waste ports or leak drains shall not be provided.
- 7. Provide one (1) spare parts kit for each pump including a complete liquid end assembly and 2 spare tubes.

**2.05 ACCESSORIES**

- A. Wall Bracket: Provide polyethylene plastic wall shelves for the pumps, large enough for the pumps to mount on. Wall bracket shall be chemically resistant.
- B. Tubing and Fittings: Provide all required tubing and fittings for a complete installation, including injection fittings, main connections, and suction strainers.
- C. Pressure Gauge
  - 1. Quantity: one (1)
  - 2. Range 0-100 PSI (sized for system)
  - 3. Provide with diaphragm seal and isolation ball valve.
  - 4. Manufacturers: Plat-O-Matic or equal preapproved by Engineer.
- D. Pressure Relief Valve
  - 1. Furnish and install one (1) pressure relief valve on the metering pump discharge line.
  - 2. Provided by the pump manufacturer and resistant to the chemical being fed.
  - 3. Manufacturer shall size the valve for the feed system.
  - 4. Furnish and install pressure relief tubing and fittings from the pressure relief valve to the tank.
- E. Back Pressure Valve
  - 1. Furnish and install one (1) backpressure valve on the metering pump discharge line.
  - 2. Provided by the pump manufacturer and resistant to the chemical being fed.
  - 3. Manufacturer shall size the valve for the feed system.
- F. Safety Equipment: Provide one (1) set of chemical handling equipment including goggles, apron, and rubber gloves.
- G. Main Line Feed Point (Corporation Stop):
  - 1. Provide 3/4-inch NPT ball valve main connection complete with diffuser.
  - 2. Product: Saf-T-Flo EB-130-B-H or pre-approved equal.
  - 3. Solution tube insertion length shall be such that fluoride is injected into the static mixer at 1/3 diameter of the water pipe.
  - 4. The solution tube tip shall be the manufacturers standard tip configuration.
  - 5. The flexible hose assembly shall be of a material compatible with the chemical being fed and the working pressure in the feed system.

**2.06 FINISHES**

- A. Factory-fabricated items shall have a factory-applied finished paint system.
- B. Other items shall be painted per Division 9.
- C. Plastic solution tank shall not be painted.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. Comply with manufacturer's Product Data, including installation instructions and details.
- B. Provide at least 1 day of installation supervision by the manufacturer's representative.

**3.02 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services:
  - 1. Inspect and approve the completed installation, make all necessary adjustments, corrections, or modifications prior to start-up.

2. After start-up is authorized by Engineer, furnish a qualified representative to inspect the completed installation, to supervise the system's initial start-up, and to train the operating personnel in operation and equipment maintenance.
3. At least 1 day shall be reserved for start-up and adjustment. See Section 01 75 00.
4. After equipment has been placed into operation, make all final adjustments for the proper operation of the equipment.

**3.03 WARRANTY**

- ~~A. Standard 1-Year Warranty: Unless otherwise stated below, manufacturer shall warrant the equipment to be free from defects in material and workmanship for a period of 1 year from the earlier of either the date established for partial utilization in accordance with GC14.04 and 14.05, as modified in the Supplementary Conditions, or Substantial Completion of the project.~~
- A. All equipment, unless otherwise stated in the contract, shall be warranted per Section 01 78 37.

**3.04 OPERATOR TRAINING**

- A. Provide a minimum of 4 hours of operator training at Owner's convenience after equipment is operational.
- B. Ensure plant personnel are sufficiently trained and thoroughly acquainted with operations and maintenance materials to operate all components of the system.

**END OF SECTION**