

Section 11260

GAS CHLORINATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

This Section includes the furnishing and subsequent installation, complete and in place, of a functioning gas chlorination disinfection system for water as shown on Plans and as specified herein.

1.02 MEASUREMENT AND PAYMENT

No separate measurement or payment for Work performed under this Section. Include cost of same in Contract price bid for Work of which this is a component part.

1.03 REFERENCES

This Specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. Chlorine Institute - Pamphlet 1: Chlorine Basics
- B. Chlorine Institute - Pamphlet 6: Piping Systems for Dry Chlorine
- C. Texas Commission on Environmental Quality (TCEQ) 30 TAC 290
- D. NFPA 70: The National Electric Code (NEC)
- E. The Hydraulic Institute (HI)

1.04 SUBMITTALS

- A. Submit the following in accordance with Sections 01330 – “Submittal Procedures” and 01782 – “Operations and Maintenance Data.”
- B. Shop Drawings and Product Data
  - 1. Catalog cuts describing equipment specified in this section and control equipment supplied with same. Mark through inapplicable information.
  - 2. Data sheets addressing all performance requirements specified in this Section.
  - 3. Data sheets addressing all product features such as materials of construction, design features, factory coatings, and accessories specified in this Section.
  - 4. Manufacturer’s installation instructions for all components and accessories

5. Shop Drawings illustrating and detailing the design and installation of the equipment specified in this Section, including:
  - a. Isometric piping diagrams
  - b. Pictorial elevations
  - c. Support and anchoring details
  - d. Piping and equipment sizes
  - e. Piping materials, types and schedules and indicated valve types and materials
  - f. Mark through inapplicable details and information
6. Catalog bulletins or comparable illustrations and data sheets for all components and accessories. Material submitted must describe and illustrate construction, dimensions, ratings, and functions of each item.
7. Ejector performance curves, including capacity in pounds per day, water supply pressure, and water supply flow rate for various back pressures.

- C. Operation and Maintenance (O&M) Manuals in accordance with Section 01782 – “Operations and Maintenance Data”

#### 1.05 RELATED REQUIREMENTS

- A. All piping, fittings, painting, electrical work, and instrumentation to be per applicable Specification Section
- B. Section 01330 – “Submittal Procedures”
- C. Section 01580 – “Project Identification Signs”
- D. Section 01782 – “Operations and Maintenance Data”
- E. Section 11263 – “Chlorine Gas Leak Detector”
- F. Section 11303 – “Chemical Analyzers”
- G. Section 15100 - "Chemical Piping"
- H. Section 16473 – “WRF Programmable Logic Controllers (PLC), SCADA Interface Panels and Panel Mounted Equipment”

#### 1.06 QUALITY ASSURANCE

- A. Standardization

1. Entire chlorine gas system, including chlorinators, ejectors, valves, diffusers, scales, and safety equipment to be provided as a package system by one vendor
2. All components of a given type to be by a single manufacturer

**B. System Coordination**

Contract Documents describe details of complete equipment installation for purpose specified. Contractor is responsible for all details necessary to properly install, adjust, and place in operation a working system.

**C. Requirements of Regulatory Agencies**

Chlorination system to comply with regulations of Texas Commission on Environmental Quality (TCEQ), the Chlorine Institute, and the National Electric Code

**D. Factory Test**

Test each pump at the factory in accordance with Hydraulic Institute Standards, using a prototype unless otherwise designated.

**1.07 SYSTEM DESCRIPTION**

System shall provide disinfection of surface water via chlorination. Chlorination is to be achieved by the use of chlorine gas. Completed disinfection system to include chlorinators, water booster pumps, alarms, controls, associated valves and piping, and other miscellaneous appurtenances discussed herein. Detailed system information is provided in "ATTACHMENT."

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver all materials and equipment to jobsite with sufficient protection to ensure arrival in undamaged condition.
- B. All mechanical equipment is to be stored on sleepers above grade and to be completely protected from damage and exposure to the elements until installation.
- C. Handle all components in accordance with manufacturer's instructions to prevent damage.

**1.09 – 1.12 (NOT USED)**

**1.13 WARRANTY**

Provide Owner with manufacturer's warranty guaranteeing the chlorinators and associated equipment to be free from defects in workmanship and materials, under normal use and service, for two (2) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

A. Chlorination Equipment

1. Superior
2. Wallace & Tiernan
3. Severn Trent Services
4. Eagle Microsystems
5. Or Approved Equal

B. Booster Pump

1. Sta-Rite
2. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

A. Chlorination System shall be sized to meet the disinfection requirements of each site. See "ATTACHMENT" for design information related to each site. This information includes manufacturer, model numbers, associated equipment, identification of drawings and details covering the chlorination system.

B. Chlorinators:

1. See "ATTACHMENT" of this Section for project specific information.
2. Visible flow, solution feed, vacuum type arranged for automatic pacing from 4-20 mA signal from PLC.
3. All necessary accessories included. Signal wiring shielded. All necessary relays included to eliminate interference with PLC.
4. Chlorine gas metered under partial vacuum created by injector located near each chlorinator.
5. Each chlorinator equipped with necessary piping and fittings. Chlorinators contain automatic safety features to prevent escape of chlorine gas in event of (1) loss of vacuum, (2) failure of water supply, (3) blockage of solution line, and (4) breakage of any part of vacuum system.
6. Each chlorinator shall include a vacuum breaker to prevent excess vacuum.

7. Each chlorinator shall be equipped with a differential regulating valve.
  8. Each chlorinator equipped with linear scale rotameter to indicate gas flow rate. Rotameter is readily removable for cleaning or changing range. Meter calibrated in pounds of chlorine per day.
  9. Chlorinator components mounted in wall mounted corrosion-resistant cabinet.
  10. All components such as vacuum regulators, control units, automatic control valves and injectors located on cylinder(s) or wall-mounted as shown on the Plans
  11. The control unit shall be microprocessor-based.
  12. Each chlorinator paced by motorized plug positioned. Pacing signal shall be by a 4–20 mA direct current signal from PLC as shown on the Plans.
  13. Furnish each chlorinator with pressure indicators to indicate injector vacuum and pressure of chlorine supply to chlorinator.
  14. The control unit shall provide manual adjustments of the gas feed rate over the full range. The automatic control signal to the control valves shall be isolated from the valve during manual operation.
  15. The control unit shall be capable of sending one (1) 2.5VDC potentiometer excitation at 4-20mA DC output into a maximum 600 ohm impedance.
- C. Ejectors:
1. Hydraulically operated ejectors furnished for each chlorinator shall be wall or pipe mounted units and sized to ensure optimum water usage and vacuum. Ejectors shall be equipped with anti-siphon devices to prevent feeding of chemicals while the chlorinators are not in operation. Ejectors shall be sized and provided by the chlorinator manufacturer.
  2. Ejectors shall be rated to a pressure that matches or exceeds the maximum back pressure that might be experienced. See "ATTACHMENT" for design points for back pressure at point of injection, design flow rate at point of injection and supply water pressure range.
- D. Dual Cylinder Scale:
1. A floor mounted dual cylinder electronic scale shall be provided.
  2. Scale shall be furnished with a remote mount dual channel electronic indicator and cable.
  3. The scale base shall be corrosion resistant and suitable for weighing two 12-inch diameter compressed gas cylinders.

4. Scale to read directly and continuously the pounds remaining in each cylinder via dual digital LED displays. Net weight to be adjustable through tare weight adjustment touch pad.
  5. Scale accuracy:  $\pm 0.5\%$  of full scale
  6. Low weight alarm contacts with a 4-20 mA transmitter.
  7. All scale electronics shall be enclosed in a NEMA 4X enclosure.
  8. Power supply shall be 120 VAC, 60 Hz
- E. Vacuum Regulator (Automatic Switchover):
1. Direct cylinder mounted vacuum regulator with flow meter assembly shall be provided.
  2. Vacuum regulator body shall be fiberglass reinforced ABS plastic. All other materials of construction shall be as recommended by the manufacturer and suitable for chlorine gas service.
  3. A fluoroplastic filter assembly shall be installed on each regulator.
  4. Vacuum regulator shall be equipped with a built-in automatic switchover function.
- F. Gas Feeder:
1. Visible flow indication
  2. Automatic safety features to prevent escape of gas in event of:
    - a. Loss of vacuum;
    - b. Failure of water supply;
    - c. Blockage of solution line; and
    - d. Breakage of any part of vacuum system
  3. Each feed point shall include a flow pacing controller on a wall panel including rotameter and vacuum gauge
- G. Chlorine Solution Diffuser:
1. Assembly shall be Saf-T-Flo Chlorine Diffuser or Approved Equal.
  2. Diffuser configuration shall provide a single feed point into the center of the water pipe. Materials of construction shall be Stainless Steel, Hastelloy C-276

or Alloy20 and compatible with chemical solution and be capable of withstanding maximum pump discharge line pressure and velocity, as well as water main pressure. Insertion depth shall be ½ diameter of the water pipe.

3. Chemical Diffuser shall be capable of installation and operation in a submerged environment external of the pipe where the injection point is located.

4. Water Main Connection:

Connection shall include a brass corporation stop valve. Threaded connection shall be male NPT inlet and capable of withstanding maximum water main pressure. Corporation Stop must include an acceptable safety device to prevent accidental release of solution tube while under maximum water main pressure and/or surge conditions.

5. Solution Tube:

- a. Solution tube shall be sized to match pump discharge line or injection flow rate.
- b. Materials of construction shall be Stainless Steel, Hastelloy C-276 or Alloy20 and compatible with chemical solution and be capable of withstanding maximum pump discharge line pressure and velocity, as well as water main pressure.
- c. An acceptable locking device must be included to prevent accidental release of the solution tube from the water main while under pressure.
- d. A ball check valve shall be included to prevent backpressure from the main from entering chemical feed system.
- e. A stainless steel safety chain shall be included to prevent withdrawal of solution tube past corporation stop. Safety chain length shall be preset by manufacturer for closure of the corporation stop before withdrawal of solution tube.

6. Operator shall be able to withdraw or insert solution tube into water main while under pressure and without having to shut down the main.

- H. Booster Pump:

1. A booster pump is to be provided to ensure sufficient water pressure and flow at the chlorine ejector.
2. Pump is to be sized to meet the flow and pressure requirements of the system at peak demand. See "ATTACHMENT" for capacity (gpm), horsepower and head (feet) for the pump.

3. Pump is to be automatically controlled by a pressure transmitter located on the potable water line supplying water to the ejectors. Should the pressure in the potable water supply line drop below the minimum pressure required for operation of the ejectors, a signal shall be sent to the booster pump to turn “ON” and begin supplying water to the ejectors. Once the pressure in the potable water supply line increases to meet the minimum pressure requirements, the transmitter shall send a signal to the booster pump to turn “OFF.” See Plans for location, wiring and operational details for the pressure transmitter and the booster pump.
- I. Signal Range Controller:
1. Signal range controller shall be utilized to determine how many chlorinators are needed to operate at a given time depending on the flow signal received.
  2. Controller to be located in the system control panel
- J. Communication
1. The chlorinators shall be equipped to transmit 4-20 mA signals to/from the pumps to a customer operated control panel or PLC and/or the NHCRWA Supervisory Control and Data Acquisition (SCADA) system.
  2. The chlorinators shall send an "ON/OFF" and "FLOW RATE" signal to the customer operated control panel or PLC and/or the NHCRWA SCADA system.
  3. The chlorinators shall be capable of receiving a flow proportional signal from the customer operated control panel or PLC and/or the NHCRWA SCADA system to control the flow rate of the pumps.
  4. See Section 16473 - "Water Receiving Facilities (WRF) Programmable Logic Controllers (PLC), SCADA Interface Panels and Panel Mounted Equipment" for more information on the interface between the chemical metering pumps and the SCADA system, if applicable.
- K. Safety Equipment:
1. Provide warning signs on doors and tanks wherever applicable, in accordance with Technical Section 01580 - “Project Identification Signs.”
  2. Provide a chlorine gas leak detector in accordance with Section 11263 – “Chlorine Gas Leak Detector.”
  3. Self Contained Breathing Apparatus (SCBA) Equipment
- Provide SCBA equipment mounted within a cabinet located on exterior of the building. SCBA equipment shall meet all Chlorine Institute and OSHA

requirements for use with chlorine gas disinfection systems. See "ATTACHMENT" for manufacturer, model and number of units provided.

2.03 FABRICATION (NOT USED)

2.04 SOURCE QUALITY CONTROL

Prior to shipment, all equipment to be tested at manufacturer's plant to demonstrate suitability of the equipment as a part of the complete installation.

PART 3 EXECUTION

3.01 – 3.02 (NOT USED)

3.03 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

- A. Materials and equipment to be installed in accordance with manufacturer's written instructions and applicable codes and ordinances
- B. Install all piping, fittings, valves and appurtenances required to install and operate the chemical feed system in accordance with Section 15100 - "Chemical Piping" and the Plans.
- C. Install all equipment specified in this section, except for chlorine solution diffuser inside proposed or existing chlorine room. Install chlorine solution diffuser in water pipeline as shown on the Plans.
- D. Install equipment in accordance with the Plans, approved shop drawings, and the manufacturer's installation instructions.
- E. Use Schedule 80 PVC pipe for potable water and chlorine solution service as called out in Section 15100 - "Chemical Piping."
- F. Use polyethylene tubing for chlorine gas service.
- G. Anchor and support all piping in accordance with approved shop drawings.
- H. Retain the services of a technician employed by the manufacturer to check the installation of the equipment and make all necessary adjustments prior to initial operation.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services
  - 1. Manufacturer's technical representative to assist Contractor in testing all equipment to ensure that it functions properly

2. Testing of Chlorine Gas Piping
  - a. Test in accordance with Chlorine Institute Pamphlet No. 6
  - b. Test using dry air or nitrogen
  - c. Test pressures as shown on the Plans
3. Upon satisfactory completion of testing, manufacturer's technical representative to assist Contractor in placing system in operation
4. Manufacturer's technical representative to assist Contractor in instructing the Owner's personnel in operation and maintenance of chlorination equipment

B. Provide an installation completion report prepared by the technician who inspected and adjusted the equipment. This report may be a letter or a form. It must be signed and dated by the manufacturer's technician. The report must indicate that installation has been satisfactorily completed in accordance with the manufacturer's instructions and is ready for operation. If that is not the case, the report must indicate what actions are needed to make the equipment ready for operation.

3.06 ADJUSTING (NOT USED)

3.07 CLEANING

Upon completion of use of the temporary chlorination system, Contractor is to restore site to original condition. All rental equipment is to be cleaned and returned to supplier. All piping and equipment to be removed and either stored or disposed of per the Project Manager's request.

3.08-3.10 (NOT USED)

END OF SECTION

**ATTACHMENT**

*[Design Engineer is to complete blanks per site requirements]*

Water District Name: \_\_\_\_\_

**Chlorinator**

Manufacturer / Model No.: \_\_\_\_\_

Designation of Unit(s): \_\_\_\_\_

Design Capacity: \_\_\_\_\_

**Ejectors**

Manufacturer / Model No.: \_\_\_\_\_

Design back pressure at point of injection: \_\_\_\_\_

Design flow rate at point of injection: \_\_\_\_\_

Supply water pressure range: \_\_\_\_\_

**Dual Cylinder Scales**

Scale Manufacturer / Model No.: \_\_\_\_\_

Scale Indicator Manufacturer / Model No.: \_\_\_\_\_

**Vacuum Regulator**

Manufacturer: \_\_\_\_\_

Feed Range Capacity: \_\_\_\_\_

**Gas Feeder**

Manufacturer / Model No.: \_\_\_\_\_

**Water Booster Pump**

Manufacturer / Model No.: \_\_\_\_\_

Capacity (gpm): \_\_\_\_\_

Horsepower: \_\_\_\_\_

Head (feet): \_\_\_\_\_

**SCBA**

Manufacturer / Model No.: \_\_\_\_\_

Number of Units: \_\_\_\_\_

**END OF SECTION**