

Section 11301

CHLORINE ANALYZERS

PART 1 GENERAL

1.01 SUMMARY

This Section includes the furnishing and installation of chlorine analyzers for monitoring of total and free residual chlorine in water from one sample point.

1.02 MEASUREMENT AND PAYMENT

No separate payment will be made for made 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. The Chlorine Institute, Inc. – Chlorine Manual
- B. NEMA ICS 1: Industrial Control and Systems General Requirements [National Electrical Manufacturers Association (NEMA)]
- C. ISO 9001: Quality Management Systems - Requirements

1.04 SUBMITTALS

- A. Submit the following Shop Drawings in accordance with Section 01330 – :Submittal Procedures:"
  - 1. Certified shop and working drawings
  - 2. Certified setting plans, with tolerances, for anchor bolts
  - 3. Operating and maintenance instructions and parts lists
  - 4. Shop Drawings details for accessory items
  - 5. Number and identify components to correspond with terminology on the Plans. Use these numbers on all submittal sheets and Shop Drawings.
  - 6. Recommendations for short and long term storage
  - 7. Sales bulletins or other general publications are not acceptable as submittals for review except where necessary to provide supplemental technical data

8. ISO 9001 certification or other quality control manual demonstrating a complete system for quality management
9. Manufacturer shall provide a list of customers using at least five (5) similar chlorine equipment systems for at least ten (10) years.
10. Material Certification:
  - a. Provide certification from the manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated.
  - b. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of three (3) years. Provide proposed materials at no additional cost to the Owner.
  - c. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

B. Provide Installation, Operations and Maintenance and Troubleshooting Manuals

C. Provide an Operations and Maintenance Manual (O&M) in accordance with Section 01782 – "Operations and Maintenance Data."

#### 1.05 RELATED REQUIREMENTS

A. Section 01330 – "Submittal Procedures"

B. Section 01450 – "Contractor's Quality Control"

C. Section 01782 – "Operations and Maintenance Data"

D. Section 11260 – "Gas Chlorination System"

E. Section 11261 – "Sodium Hypochlorite (Bleach) Chlorination System"

F. Section 15100 – "Chemical Piping"

G. Section 16473 - "Water Receiving Facilities (WRF) Programmable Logic Controllers (PLC), SCADA Interface Panels and Panel Mounted Equipment"

#### 1.06 QUALITY ASSURANCE

A. Comply with the requirements specified in Section 01450 – "Contractor's Quality

Control."

- B. Do work required by and in accordance with applicable State and local codes; arrange for permits, inspections and tests required by these codes.
- C. Provide systems and items of equipment that conform to applicable safety standards including those for safety of personnel.
- D. Provide components to manufacturer's standard for service intended unless otherwise required.
- E. Provide equipment of manufacturers' latest and proven design. Unit to be a standard cataloged product and as specified and indicated.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE AND HANDLING

Pack materials to permit ease of handling and to provide protection from damage during shipping, handling and storage.

1.09 - 1.12 (NOT USED)

1.13 WARRANTY

- A. Warranted from manufacturer defects for one year from date of shipment.

Contractor shall provide a Manufacturer's Service Agreement that covers all the Manufacturer's recommended preventative maintenance and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 24 months of end-user operation post turnover.

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. Hach
- B. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

- A. The analyzer package shall consist of a sample and reagent valve and pump, measurement cell, controller, and is shipped with buffer and indicator solutions.

- B. Sample Flow Rate:

0.053 gallons/minute (200 mL/minute) to 0.132 gallons/minute (500 mL/minute)  
minimum

C. Measurement:

1. The method of measuring free or total chlorine shall be colorimetric. Instrument chemistry will employ N, N-diethyl-p-phenylenediamine (DPD) method.
2. The analyzer shall be capable of measuring free or total residual chlorine by changing the tubing and indicator and buffer solutions.
3. A measurement shall be taken every 2.5 minutes and results displayed by a three digit LCD readout in the range of 0 to 5 mg/L.

D. The analyzer must perform a self-test and auto-blanking between analysis points to compensate for sample color, turbidity, and changes in light intensity due to voltage fluctuations or light source aging.

E. The analyzer shall come with dual pressure regulators designed by the manufacturer for use with the analyzer.

F. Pressures:

1. Inlet Pressure (without conditioning):  
1 to 5 psig with an optimum pressure of 1.5 psig. Design shall provide for not exceeding 5 psig, due to risk of sample tubing failure.
2. Pressure Limit (with conditioning): 1.5 psi to 75 psi
3. Provide pressure regulator(s) required to control pressure at acceptable ranges entering the analyzer.

G. Piping Connections:

1. Inlet Fitting at instrument:  
¼-inch OD polyethylene tubing with quick-disconnect fitting
2. Drain:  
0.50 inch inner diameter (ID) flexible tubing
3. Air Purge (optional):  
0.1cfm instrument quality air at a maximum of 20 psig with 1/4 inch outer diameter (OD) tube with quick connect fitting

H. Performance:

1. Operating range:  
0 to 5 mg/L free or total residual chlorine
2. Accuracy:  
± 5% of reading or ± 0.03 mg/L (ppm) as  $Cl_2$  whichever is greater
3. Precision:  
± 5% of reading or ± 0.01 mg/L ppm whichever is greater
4. Minimum Detection Limit: 0.03 mg/L (ppm)
5. Cycle Time: 2.5 minutes
6. Resolution: 0.01 mg/L (ppm)
7. Repeatability: 0.05 mg/L (ppm)

I. Environmental Conditions

1. Storage Temperature: -4°F to 140°F
2. Sample Temperature: 41°F to 104°F
3. Operating Temperature: 41°F to 104°F
4. Humidity: 90% at 104°F

J. Reagents

1. Maximum Reagent Usage: ½-liter per month per reagent
2. Containers: High-density polyethylene (2) ½ liter bottles
3. Containment: Reagent bottles are contained inside the analyzer enclosure and are vented externally
4. Provide three (3) month's supply of reagents, standards, and cleaning solution (1.5 liters of each reagent)
5. Manufacturer shall provide certified pre-mixed reagents and standards

K. Display:

LCD, 3 ½-digit measurement readout and six-character alphanumeric scrolling text line

L. Enclosure:

Made of ABS Plastic with two polycarbonate windows. NEMA 12 enclosure that is rated IP62 with a gasketed door latch.

M. The analyzer shall operate with an LED light source at a peak wavelength of 520 nm.

N. Power Requirements: 100 – 115/230 VAC; 50/60 Hz, 2.5 Amp fuse

O. The analyzer shall be equipped with two standard Single Pole Double Throw (SPDT) relay alarms, with contacts rated for 5 amp resistive loads at 230V AC power. Alarm options include:

1. Concentration set point
2. Analyzer system warning
3. Analyzer system shut down

P. Chlorine Residual Titrator:

1. Amperometric type, portable, and capable of operating on either self-contained, rechargeable battery or standard 120-volt alternating current.
2. Minimum supply of 500 ml of phenylarsene oxide, potassium iodide, pH 4 buffer and pH 7 buffer solutions included.
3. Comparator unit furnished complete in carrying case and with carrying case for accessories.

Q. Power Supply:

Power shall be directly connected to the analyzer or use a power cord supplied by the Contractor. See "ATTACHMENT" and Plans for type of connection.

R. Communications and Controls:

1. Analyzer shall be provided with all necessary hardware and software needed to allow all data to be sent to the customer operated control panel or PLC and/or the Owner's Supervisory Control and Data Acquisition (SCADA) system. 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 analyzer and the Owner's SCADA system, if applicable.
2. The analyzer shall have two feed control (relay) operation modes to operate chemical feed pumps or chlorinators. Available control options are:
  - a. On/off control where the concentration alarm outputs activate or

- deactivate a pump when chlorine levels fall below or exceed acceptable levels.
- b. Proportional control where the 4-20mA output current is scaled to pace a feed pump proportional to output.
- 3. The analyzer has standard optically isolated analog outputs, selectable as 0/4 to 20mA, field programmable over any portion of the analyzer range
- 4. Alarms:
  - a. Each alarm is equipped with and SPDT relay with contacts rate for 5 Amp resistive load at 230 Volts AC
  - b. Provide two alarms selectable for the following:
    - 1) Sample Concentration Alarm
    - 2) Analyzer System Warning
    - 3) Analyzer System Shutdown Alarm
- 5. Provide one 4-20 mA analog output with a span programmable over any portion of the 0 to 5 mg/L range.
- 6. Analyzer shall be able to transmit the total and free chlorine concentrations to the customer operated control panel or PLC and/or the Owner's SCADA system.

S. Network Capability:

Analyzer shall be equipped with network capability, with the following characteristics:

- 1. Receive input for up to eight sensors
- 2. Operate at a humidity of 5 to 95% non-condensing and a temperature of 32°F to 104°F
- 3. Power requirements:
  - a. External power supply of 12 Volts DC, nominal  $\pm 25\%$
  - b. (9 to 15 VDC range) with peak to peak ripple to be less than 10% of nominal.
- 4. Enclosed in a NEMA 4X indoor enclosure rated at IP 66 that can be mounted on a wall, panel or pole
- 5. Display visibility LCD backlit, visible at 10 feet with single reading; visible at 3 feet with multiple readings

6. Real time clock
7. Outputs:  
  
Two current analog outputs; range either 4-20 mA or 0-20 mA (user selectable); both outputs isolated to 500 VDC; may be trimmed  $\pm 20\%$  if needed
8. Relays: SPDT 250 VAC, 5A resistive
9. Communications:
  - a. Fieldbus compatible; maximum of 400 meters between devices with a 500 meter maximum per segment; distances in excess of 500 meters require a repeater. Up to 3 repeaters can be used for a total network length of 2000 meters.
  - b. Data logging capability:  
  
1 hour log (1 min. intervals), 30 day log (15 min. intervals)
  - c. Capable of Master or Remote operation with the capability of communicating with multiple devices.
- T. Number of Analyzers:  
  
See "ATTACHMENT" and Plans for number of analyzers.
- U. The analyzer shall provide for continuous purge of sample to drain to assure fresh sample to the analyzer and reduce analysis lag time.
- V. The analyzer shall provide separate discharge lines for unchanged (bypass) and contaminated sample (waste)
- W. Provide Installation Kit and Wall Mount Kit for all analyzers
- X. Provide a rotameter on each sample line upstream of analyzer to control flow rates entering the analyzer.
- Y. Provide pressure relief valve and pressure regulator immediately upstream of analyzer on sample line to control the pressure of the line entering the analyzer.

2.03 - 2.04 (NOT USED)

### PART 3 EXECUTION

3.01 GENERAL / MANUFACTURERS (NOT USED)

3.02 PREPARATION

A. Mounting:

Analyzer can be wall mounted

B. Sample Inlet:

1/4 inch outer diameter (OD) polyethylene tubing

C. Sample Outlet:

0.50 inch inner diameter (ID) flexible tubing

D. Overflow Drain:

0.50 inch inner diameter (ID) flexible tubing

E. Air purge quick connect (optional):

0.25 inch outer diameter (OD) polyethylene tubing

3.03 ERECTION / INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Contractor shall install the analyzer and connecting piping in strict accordance with the Manufacturer's instructions.

B. Prior to testing and start-up, inspect the installation to verify the system is ready for complete testing and calibration of equipment.

C. Manufacturer's representative shall include a half-day start-up service by a factory trained technician.

D. Contractor shall schedule a date and time for start-up.

E. Contractor shall require the following people to be present during the start-up procedure.

1. General Contractor
2. Electrical Contractor
3. Manufacturer's factory trained representative
4. Project Manager
5. Owner's Operator
6. Water District Operator

- 7. Engineer
- 8. Controls Technician (as required)
- F. Install all piping, fittings, valves and appurtenances required to install and operate the analyzers in accordance with Section 15100 - "Chemical Piping" and the Plans.
- G. For all associated chlorination equipment to be installed, refer to Section 11260 – "Gas Chlorination System" or 11261 – "Bleach Chlorination System."

3.04-3.07 (NOT USED)

3.08 DEMONSTRATION, TESTING AND INSPECTION

- A. Contractor shall include the Manufacturer's services to perform start-up on instrument to include basic operational training and certification of performance of the instrument.
- B. Manufacturer's technical representative to assist Contractor in testing and calibration of all components.
- C. Contractor shall include a Manufacturer's Service Agreement that covers all the Manufacturer's recommended preventative maintenance, and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 24 months of end-user operation post turnover.
- D. Items A and C are to be performed by Manufacturer's factory-trained service personnel. Field service and factory repair by personnel not employed by the manufacturer is not allowed.
- E. Test chemical feed system per Section 11260 – "Gas Chlorination System" or 11261 – "Bleach Chlorination System."
- F. Use of manufacturer's service parts and reagents is required. Third-party parts and reagents are not approved for use.

3.09-3.10 (NOT USED)

END OF SECTION

**ATTACHMENT**

A. Chlorine Analyzer

1. Manufacturer: Hach
2. Model: CL-17
3. Type of Mounting: Wall Mounted
4. Power connection: Directly connected or use a power cord

END OF SECTION