

PART 1 GENERAL

1.1 Section includes

- A. Amperometric chlorine analyzer for continuous measurement of free or total chlorine in aqueous solutions.

1.2 Measurement Procedures

- A. The method of measuring free or total chlorine will be with a three-electrode amperometric sensor immersed into an electrolytic medium with a membrane, selective to chlorine, separating it from the sample.

1.3 Alternates

- A. Other methods of chlorine measurement, such as two-electrode amperometric, open cell amperometric, or measurements with external pH compensation are not acceptable.

1.4 System Description

A. Performance Requirements

1. Measurement range: 0 to 20 ppm chlorine for either free or total chlorine
2. Total Chlorine
 - a. Low Limit Of Detection (LOD): 30 ppb (0.03 ppm) or better
 - b. Limit Of Quantitation (LOQ): 90 ppb (0.09 ppm) or better
 - c. Repeatability/precision: 30 ppb or 3%, whichever is greater
 - d. Response time: ~100 s for 90% change (T_{90}) (At a stable T and pH)
 - e. Interference: Chlorine Dioxide, Ozone, and chalk deposits
3. Free Chlorine
 - a. Low Limit Of Detection (LOD): 30 ppb (0.03 ppm) or better
 - b. Limit Of Quantitation (LOQ): 90 ppb (0.09 ppm) or better
 - c. Repeatability/precision: 30 ppb or 3%, whichever is greater
 - d. Response time: ~140 s for 90% change (T_{90}) (At a stable T and pH)
 - e. Interference: Monochloramine, Chlorine Dioxide, Ozone, and chalk deposits
4. Drift: <10% with regular calibration (calibration will be weekly to quarterly depending on the application, given stable sample temperature and pH of water sample)
5. Specificity/Selectivity: Non-specific to a certain chlorine form, responds to any chlorine species and other oxidizers as noted in the interference section
6. Calibration method: Customer has the option to use one (zero or slope) or two point (zero and slope) calibration. Two point calibration with chemical zero is recommended for chlorine concentration <0.5 ppm
7. Verification procedure: One-point process calibration (slope) against a standard reference method.

1.5 Certifications (when connected to a Hach sc controller):

- A. EMC: CE compliant for conducted and radiated emissions CISPR 11 (Class A limits), EMC Immunity EN 61326-1 (Industrial limits)
- B. Safety: General Purpose UL/CSA 61010-1 with cETLus safety mark
- C. Australian C-TICK and Korean KC Markings
- D. NEMA 4X/IP65 Water and Dust Ingress Ratings

1.6 Environmental Requirements

- A. Operational Criteria
 - 1. Operating temperature: 5 to 45 °C (41 to 113 °F)
 - 2. Relative humidity: 0-95%, non condensing
- B. Sample Requirements
 - 1. Maximum back pressure the chlorine sensor can manage without failure:
 - a. 0.5 bar, no pressure impulses and/or vibrations
 - 2. Temperature: 0 to 45 °C (33 to 113 °F)
 - 3. Temperature compensation range: 5 to 45 °C (41 to 113 °F)
 - 4. Flow: 30-50 L/hr, 40 L/hr - optimal (7.9-13.2 g/hr, 10.6 g/hr - optimal)
- C. Storage Requirements
 - 1. Electrolyte: 15 to 25°C (59 to 77°F)
 - 2. Chlorine sensors: 0 to 50°C (32 to 122°F) dry without electrolyte
 - 3. Panel: -20 to 60°C (-4 to 149°F)

1.7 Warranty

- A. The product includes a one-year warranty from the date of shipment.

1.8 Maintenance Service

- A. Scheduled maintenance:
 - 1. Calibration by comparison with lab method: every 1 month or as necessary
 - 2. Replace membrane: every 6 months or as necessary
 - 3. Replace electrolyte: every 3 to 6 months or as necessary
- B. Unscheduled maintenance
 - 1. Cleaning as needed based on environmental conditions.
 - 2. Working electrode tip polishing when required

PART 2 PRODUCTS

2.1 Manufacturer

- A. Hach Company, Loveland, CO
 - 1. Model CLF10sc Reagentless Free Chlorine Analyzer
 - 2. Model CLT10sc Reagentless Total Chlorine Analyzer

2.2 Manufactured Unit

- A. The CLF10 sc or CLT10sc analyzer consists of:
 - 1. Three-Electrode Amperometric Chlorine sensor
 - 2. Chlorine sensor flow cell with integrated flow sensor
 - 3. pH flow cell with grab sample port
 - 4. Digital gateway for communication between probes and controller
 - 5. Stainless steel panel

2.3 Equipment

- A. The CLF10 sc and CLT10 sc work with Hach sc model controllers only. (Specific controller specifications can be found in the associated sensor CSI specifications)
- B. The amperometric cell of the sensor consists of:
 - 1. Gold cathode
 - 2. Stainless steel counter electrode
 - 3. Silver/silver chloride reference electrode
 - 4. pH buffered electrolyte
 - 5. Sensor membrane to filter chlorine species selectively and to provide interface between the electrochemical cell and the sample
- C. Wetted materials as follows:
 - 1. Chlorine Measuring Cell: PVC
 - 2. Chlorine Sensor Body: PVC
 - 3. Chlorine Sensor Flow Cell: Acrylic
 - 4. Optional pH Sensor Flow Cell: PVC
- D. The sensor interface to the controller is through a digital gateway.
- E. The chlorine sensor automatically compensates for temperature utilizing an embedded temperature sensor.
- F. The electrolyte provides internal, buffered pH compensation in the range of 4-9 pH units.
- G. The sensor includes proprietary Cal Watch self-diagnostic technology.
- H. The panel assembly includes a flow cell that integrates a flow meter and control valve.

2.4 Components

- A. Standard equipment:
 - 1. Stainless Steel Mounting Panel
 - 2. Chlorine Sensor with Membrane and Electrolyte
 - 3. Chlorine Sensor flow cell
 - 4. Flow meter with control valve
 - 5. Digital gateway to sc controller with cable
 - 6. User Manual
- B. Dimensions
 - 1. Sensor
 - a. Length: 7.68 in. (195 mm)
 - b. Diameter: 0.98 in. (25 mm)
 - 2. Panel

- a. Length: 19.0 in. (482.6 mm)
- b. Width: 19.5 in. (495.3 mm)
- c. Depth: 5.95 in. (151.2 mm)
3. Gateway to Controller cable: 3 ft. (1 m)
- C. Weight
 1. Panel and empty panel-mounted components: approximately 12 lbs. (5.5 kg)
 2. Complete panel with pH sensor: approximately 20 lbs. (9.1 kg)

2.5 Accessories

- A. Required
 1. sc Controller
- B. Optional
 1. pH sensor
 2. Acidification unit
 3. Sample conditioning kit

PART 3 EXECUTION

3.1 Preparation

- A. Clearances
 1. The pre-assembled analyzer panel must be mounted to allow clearance for sensor removal and routine maintenance.
- B. Mounting
 1. Wall or panel mounted
- C. Sample Inlet (order with English or Metric Fittings)
 1. English Fittings
 - a. Speed-fit fitting – ¼ in OD Tube
 2. Metric Fittings
 - a. Speed-fit fitting – 6 mm OD Tube
- D. Sample Outlet (order with English or Metric Fittings)
 1. English Fittings
 - a. Speed-fit fitting – ½ in OD
 2. Metric Fittings
 - a. Speed-fit fitting – 12 mm OD

3.2 Installation

- A. Contractor will install the analyzer in strict accordance with the manufacturer's instructions and recommendation.
- B. Manufacturer's representative will include a half-day of start-up service by a factory-trained technician, if requested.
 1. Contractor will schedule a date and time for start-up.
 2. Contractor will require the following people to be present during the start-up procedure.
 - a. General contractor

- b. Electrical contractor
- c. Hach Company factory trained representative
- d. Owner's personnel
- e. Engineer

3.3 Manufacturer's Service and Start-Up

- A. Contractor will include the manufacturer's services to perform start-up on instrument to include basic operational training and certification of performance of the instrument.
- B. Contractor will include a manufacturer's Service Agreement that covers all the manufacturer's recommended preventative maintenance, regularly scheduled calibration and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 12 months of end-user operation post turnover.
- C. Items A and B 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.
- D. Use of manufacturer's service parts and reagents is required. Third-party parts and reagents are not approved for use.

END OF SECTION